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OBSERVATIONS ON THE BIOLOGY OF PACIFIC HAKE, WALLEYE POLLOCK AND SPINY DOGFISH IN THE STRAIT OF GEORGIA, JUAN DE FUCA STRAIT AND OFF THE WEST COAST OF VANCOUVER ISLAND AND THE UNITED STATES ARCTIC HARVESTER JULY 13-24, 1976.

by

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ABSTRACT

R. J. Beamish, G. A. McFarlane, K. R. Weir, M. S. Smith, J. R. Scarsbrook, A. J. Cass, and C. Wood. 1982. Observations on the biology of Pacific hake, walleye pollock and spiny dogfish in the Strait of Georgia, Juan de Fuca Strait and off the west coast of Vancouver Island and the United States. Arctic Harvester July 13-29, 1976. Can. MS Rep. Fish. Aquat. Sci. 1651: v + 150 p.

A total of 43 midwater tows were completed, 26 in the Strait of Georgia, 5 in Juan de Fuca Strait and 12 off the west coast of Canada and the United States.

Pacific hake in the Strait of Georgia were slower growing as adults than hake in Juan de Fuca Strait or off the west coast of North America. The modal length in the Strait of Georgia was 43-45 cm, compared to 48-51 cm in Juan de Fuca Strait and 54-56 cm off the west coast of Vancouver Island. Pacific hake in the Canadian zone off the west coast of Vancouver Island were larger and older than hake found off Washington and Oregon which had a modal length of 48 cm.

Strong year-classes were evident in the offshore population. The independent identification of the strong 1970 year-class as a dominant age group in all samples from the west coast of North America provides partial validation of the age determination method using sections of otoliths.

Pacific hake ranged in age from 1-19 yrs in the Strait of Georgia and 3-17 years in Juan de Fuca Strait and offshore. Age composition using otolith sections indicated annual natural mortality rates may be A=0.5-0.6 for hake from the Strait of Georgia and A=0.4-0.5 for the offshore stock.

Walleye pollock were present in most sets except those made off the west coast of the United States. Pollock were small with most fish ranging in size from about 30-50 cm. The modal size in the Strait of Georgia was 38 cm, 36 cm in Juan de Fuca Strait and 40 cm off Vancouver Island. Pollock off Vancouver Island ranged in age from 1+ to 5+ years with 3+ fish being the dominant age-group. Most fish spawned for the first time at age 3.

Spiny dogfish were present in most sets except those off the west coast of the United States. A total of 3,409 were measured and 88% were $\leq$60 cm. Juvenile dogfish ($\leq$60 cm) were predominant in the surface waters at this time of year, although some were found at most depths. Most juveniles were younger than 15 years. There appeared to be a definite movement of larger and older fish away from the surface waters. Growth curves and length frequency histograms indicated an average annual growth increment of 1-2 cm. Analysis of the catch curve indicated an annual mortality rate of A=0.17 and instantaneous rate Z=0.19.

A variety of other species, including salmon were sampled as time permitted.

Key words: Biology, Pacific hake, walleye pollock, spiny dogfish, Strait of Georgia, Juan de Fuca Strait, west coast Vancouver Island, west coast United States.

RÉSUMÉ

R. J. Beamish, G. A. McFarlane, K. R. Weir, M. S. Smith, J. R. Scarsbrook, A. J. Cass, and C. Wood. 1982. Observations on the biology of Pacific hake, walleye pollock and spiny dogfish in the Strait of Georgia, Juan de Fuca Strait and off the west coast of Vancouver Island and the United States. Arctic Harvester July 13-29, 1976. Can. MS Rep. Fish. Aquat. Sci. 1651: v + 150 p.

On a effectué au total 43 traits de chalut mésopélagique, dont 26 dans le détroit de Géorgie, 5 dans de détroit de Juan de Fuca et 12 au large de la côte ouest du Canada et des États-Unis.

Les merlus du Pacifique adultes ont connu une croissance plus lente dans le détroit de Géorgie que dans le détroit de Juan de Fuca ou au large de la côte ouest de l'Amérique du Nord. Le mode de la longueur dans le détroit de Géorgie variait de 43 à 45 cm, contre de 48 à 51 cm dans le détroit de Juan de Fuca et de 54 à 56 cm au large de la côte ouest de l'île Vancouver. Les individus prélevés dans la zone canadienne au large de la côte ouest de l'île Vancouver étaient plus gros et plus âgés que ceux trouvés au large des États américains de Washington et de l'Orégon, dont le mode de la longueur était de 48 cm.

Dans la population du large, on a noté des classes d'âge fortement représentées. On a constaté que l'abondante classe d'âge de 1970 était le groupe d'âge dominant dans tous les échantillons provenant de la côte ouest de l'Amérique du Nord, ce qui confirme en partie la valeur de la méthode de détermination de l'âge par l'étude de sections d'otolithes.

L'âge des merlus du Pacifique variait de 1 à 19 ans dans le détroit de Géorgie et de 3 à 17 ans dans le détroit de Juan de Fuca et au large. La répartition des âges déterminée par l'examen des sections l'otolithes a indiqué que le taux annuel de mortalité naturelle pourrait être de A=0,5 à 0.6 pour les individus provenant du détroit de Géorgie et de A=0, 4 à 0,5 pour la population vivant au large.

Il y avait des morues du Pacifique occidental dans la plupart des échantillons sauf dans ceux prélevés au large de la côte ouest des

États-Unis. Les morues de petite taille, mesuraient pour la plupart entre 30 et 50 cm. Le mode de la taille était de 38 cm dans le détroit de Géorgie, de 36 cm dans le détroit de Juan de Fuca et de 40 cm au large de l'île Vancouver. L'âge des morues au large de l'île Vancouver variait entre 1+ et 5+ ans, les poissons de 3+ ans constituant le groupe d'âge dominant. La plupart des poissons ont frayé pour la première fois à l'âge de trois ans.

Il y avait des aiguillats dans la plupart des échantillons, sauf dans ceux prélevés au large de la côte ouest des États-Unis. Au total, 3 409 spécimens ont été mesurés et 88 % d'entre eux avaient une longueur $\leq$ 60 cm. A cette époque de l'année, les jeunes aiguillats ($\leq$ 60 cm) étaient en plus grand nombre dans les eaux de surface bien qu'un certain nombre ait été capturé à presque toutes les profondeurs. La plupart des jeunes avaient moins de 15 ans. Les poissons plus gros et plus âgés semblaient nettement s'éloigner des eaux de surface. Les courbes de croissance et les histogrammes de fréquences des longueurs ont indiqué une croissance moyenne annuelle de 1 à 2 cm. L'analyse de la courbe de capture a indiqué un taux annuel de mortalité de A=0,17 et un taux instantané de mortalité de Z=0,19.

Lorsque le temps l'a permis, divers autres espèces, y compris le saumon, ont été prélevées.

Mots-clés: Biologie, merlu de Pacifique, morue du Pacifique occidental, aiguillat, détroit de Géorgie, détroit de Juan de Fuca, côte ouest de l'île Vancouver, côte ouest des États-Unis.

INTRODUCTION

The purpose of this cruise was to study and compare the biology of Pacific hake (Merluccius productus), walleye pollock (Theragra chalcogramma) and juvenile spiny dogfish (Squalus acanthias) in the Strait of Georgia, Juan de Fuca Strait and off the west coast of North America.

This report summarizes the study conducted on these species from July 13-29, 1976, and is intended to provide biological data as part of the continuing program to examine hake, pollock and dogfish stocks in the Strait of Georgia as well as to provide a base for future studies offshore.

METHODS

The ARCTIC HARVESTER is a 44.5-m commercial stern trawler of 696 gross tons, powered by a 1,000 Hp diesel engine. A Simrad 38A scientific sounder was used to locate fish concentrations while the depth of the net and the vertical net opening were determined with an ELAC LAZ 17 netsounder.

A Canadian Diamond 5-B midwater trawl with a 43.3-m (142-ft) headrope and 40-m (132-ft) sideropes was used for all tows. A 3.8-cm stretched-mesh herring codend was used for tows 1-29, then a 2.5-cm stretched-mesh codend liner was installed and used for the remainder of the cruise.

At two locations in the Strait of Georgia a series of tows were made at various depths during the day and night to examine the species composition.

An expendable bathythermograph (XBT) was used at each station beginning with tow 6, to record temperature profiles to a depth of 274 m.

The catch from each set was sorted by species into 55 L (12 gal) galvanized tubs, weighted and recorded. Small catches were sampled in their entirety, while a representative subsample was taken from large catches.

Hake and pollock were measured for fork length and random samples of tubs of fish were sampled for sex, maturity, stomach contents and age. Age was determined for hake using otoliths (Beamish 1978), and for pollock using sections of pectoral fins (Beamish 1981). Dogfish were measured for total length from the tip of the snout to the tip of the upper lobe of the caudal fin when depressed in a line horizontal with the body. Spines from the second dorsal fin were collected for age determination. The method of ageing described by Ketchen (1975) was used except that all ages were calculated from birth. When time permitted other species such as salmon, Pacific cod, lingcod, brown catshark, rockfish, lamprey, sablefish, eulachon and Jack mackerel were sampled. Small fishes and lamprey captured in the trawl were preserved for identification in the laboratory.

RESULTS AND DISCUSSION

GENERAL CRUISE SUMMARY

A total of 43 midwater sets were completed during the cruise. Twenty-six of these tows were made in the Strait of Georgia, 5 sets were completed in Juan de Fuca Strait and 12 sets were located offshore along the coast of Oregon, Washington and southern British Columbia (Fig. 1). Pacific hake was present in 36 of the tows and was the most common of the 37 species captured (Table 1). Pollock and dogfish were common in the catches but were much less abundant than hake.

In the Strait of Georgia, echograms frequently showed that a concentrated scattering layer occurred at a depth of about 100-170 m and approximately 65% of all tows were made in or above this layer. Hake catches averaged 2,008 kg/hr in or above the scattering layer and 197 kg/hr below the scattering layer. Catches of pollock averaged 157 kg/hr in or above the scattering layer and 38 kg/hr below the scattering layer. Dogfish catches averaged 78 kg/hr in or above the scattering layer and 40 kg/hr below the scattering layer. Therefore, hake, pollock and juvenile dogfish at this time of year tended to be concentrated above the scattering layer.

The use of the scattering layer to separate catches is meaningful only when major differences in abundance are apparent. This layer, which appears to be a plankton layer, is not always distinct and separation of catches into the two categories is sometimes uncertain. However, despite these imprecisions it has been observed that this layer is a useful reference about which to describe the vertical distribution of species in the Strait of Georgia.

A list of common and scientific names, vertical temperature profiles for each set and set information are included in Appendix Tables 1, 2 and 3.

Detailed discussions of the results are included in the following summary by major geographical areas.

PACIFIC HAKE

Strait of Georgia

Pacific hake were present in 23 of the 26 sets made in the Strait of Georgia (Table 2). A total of 4,976 hake were measured and sexed, 335 of these were examined for stage of maturity and 192 pairs of otoliths were collected for age determination. Hake ranged in length from 9-73 cm but most adult hake ranged in size from 43-45 cm (Table 3). Modes were evident at lengths of approximatley 14, 26 and 38 cm that probably represent the modal length of hake that have completed 1, 2 and 3 years growth, respectively. Females composed 51% of the sample indicating there was no difference in the

number of males and females in the sample and probably in the population. All hake had spawned and most (77%) had gonads that were in a "resting" stage, however, a few males still had milt flowing from the vent.

A total of 40 fish were examined from one set at Thrasher Rock for stomach contents. Twenty-five percent had everted stomachs, 58% were empty and 17% contained food items. The average volume of stomach contents of all hake examined (including empty stomachs, excluding everted stomachs) was 0.2 cc. Unidentified plankton composed 86% of the total volume and unidentified shrimp 14%.

Ages were determined using both surface otolith readings and readings from sections of otoliths (Beamish 1979). Both methods produced similar ages up to and including fish age 4 (Table 4). Estimates of natural mortality using the Jackson (1939), Robson and Chapman (1961) methods require constant annual recruitment. However, the catch curves (Fig. 2) indicates that annual recruitment was not constant. Tentative annual mortality rates (A) calculated from the descending limb of the catch curves by these methods ranged from 0.5-0.6 using surface ages and section ages, respectively. Recent investigations (Beamish 1981; McFarlane et al. in preparation) revealed that strong year-classes may be an important component of this population and that the high estimated mortality rates could be the result of a strong year class being fully recruited and subsequently moving through the population. As consecutive years of age samples are required to make accurate estimates of mortality, the true rate could be lower.

Pacific hake in this sample matured in their 3rd year of growth (age 2+) and more than 50% of the males and females spawned as age-3 fish (Fig. 3). Similar results were obtained for ages estimated from otolith sections and the surface of the otolith. However, because the sample size is small it is possible that immature fish in the population were not sampled in equal proportion to mature fish and larger sample sizes should be taken in an attempt to obtain an unbiased estimate of age at first maturity.

The series of day and night hauls (set 6-9) and the series of horizontal hauls made at two different locations (sets 32-37 and 38-43) are difficult to interpret. While there was no method of opening and closing the net at each depth (Table 5), there was some indication that hake moved closer to the surface during the evening at this time of year.

Juan de Fuca Strait

Five sets were made in Juan de Fuca Strait and hake were found in 3 of the 5 sets. Hake were larger than found in the Strait of Georgia, ranging in size from 41-81 cm with a modal size ranging from 48-51 cm (Table 6). The percent of females in the sample of 876 fish sexed was 66%, much higher than observed in the Strait of Georgia. All adults had completed spawning and the gonads appeared to have returned to the "resting" state. A number of males (42%) still retained milt and thus were still recovering from spawning. Six of the 191 hake sampled for maturity and otoliths were immature.

A sample of 10 hake were selected for age determination from each cm length class. Age determined independently using otolith sections and the

surface of the otolith were similar (Table 7). Six-year-old hake (1970 year-class) was the dominant age group for males and females, although minor modes were detectable for 9- and 12-year-olds. Hake in Juan de Fuca Strait were considerably larger than similar aged fish from the Strait of Georgia. This apparent difference in growth and the difference in modal ages clearly indicates the Strait of Georgia and Juan de Fuca Strait hake are separate stocks.

West Coast Vancouver Island

Seven sets were made off S.W. Vancouver Island (Fig. 1). Hake were present in 6 of the 7 catches and 970 were sampled for length and sex. A total of 882 of these were sampled for state of maturity and 541 otoliths were collected for age determination.

Hake ranged in length from 44-81 cm (Table 8). Males ranged from 44-77 cm and had a modal length at 54 cm (Fig. 4). Females ranged in size from 45-81 cm with modes appearing in the length frequency histogram at 47, 53, 58 and 60 cm (Fig. 4). Females composed 75% of the catch and the percent of females larger than 60 cm (40%) in the catch was greater than the percent of larger males (25%).

All hake (99%) were mature adults that were recovering from spawning. Females were in a more advanced stage of recovering and 13% of the males still had some milt flowing from the vent.

Age was estimated from a total of 527 otoliths (sets 14, 27) using otolith sections. Otolith surface age estimates produced more younger fish (Table 9) and identified 2 strong age-groups at age-7 (1969 year-class) and age-9 (1967 year-class). Since ages estimated from sections have been considered to be more reliable for older Pacific hake (Beamish 1979), the section ages were considered to be better estimates of the age structure of the population. Section ages indicated that fish ranged in age from 4 to 17 years with prominent age-groups at age-6, (1970 year-class), age-9 (1967 year-class), age-12 (1964 year-class) and age-15 (1961 year class). While the sample size may be small there is a striking periodicity of strong year classes every 3 years. The strong 1970 year-class also has been identified in other areas off the west coast of North America (Dark et al. 1980).

The dominant age-groups in this sample were identical to the dominant age groups from Juan de Fuca Strait. However there were a greater percentage of age-6 fish in the Juan de Fuca sample. The growth pattern on the section of otoliths from the west coast of Vancouver Island and Juan de Fuca Strait were similar and wider than observed in the Strait of Georgia. This similarity in age structure and the dominance of females in both areas suggests that Pacific hake in both areas are part of the same stock.

It was interesting that the modal lengths observed in the length frequency sample did not correspond to any particular age group. The mode at about 54 cm corresponds to ages 6 and 7 and the 58-cm mode to ages 8, 9, and 10.

Off Washington and Oregon

Five sets were made from July 18-21 off the west coast of the United States. Pacific hake were present in 4 of the 5 sets (Table 10) and 1,004 hake were sampled from sets 15, 16 and 17 for length, sex, maturity and otoliths (Table 2). Hake from these sets were smaller than those found in the Canadian zone. The males ranged from 39-59 cm and the females from 41-66 cm. A modal length of 48 cm was evident from the length frequency of both sexes. Almost no large fish were present. No males were found that were $\geq$60 cm and only 1% of the females were $\geq$60 cm. While the percent of females (60%) was larger than the percent of males, the percentage of females was less than observed in the Canadian zone.

All hake (99%) were mature adults that were recovering from spawning. Females were in a more advanced stage of recovery than males, but fewer males ($\sim$ 1%) were observed with milt running from the vent than had been observed in the other areas.

The length frequencies from the foreign commercial fishery off the states of Washington and Oregon from July-October 1976 (Fig. 5) are almost identical with the length frequencies found in this study (Fig. 6). Since very few fish larger than 60 cm occurred in either the foreign catch or in the samples collected in this study it appears that a larger percent of larger hake are found exclusively in the Canadian zone at this time of year.

Ages were estimated using otolith sections from 658 otoliths collected in sets 15 and 17. Six-year-old hake were the dominant age-group representing 50.9% of all age-groups (Table 11). In contrast to the sample collected off Vancouver Island, no other dominant age-groups were present. The mean size of similar aged fish of both sexes were smaller than found off Vancouver Island. For example; the mean size of age-6 females (48.9 cm) was slightly smaller than age-6 females in Juan de Fuca Strait (50.4 cm) and significantly smaller (t test $P \leq 0.05$) than the mean size of 6 year olds (53.5 cm) off the west coast of Vancouver Island. The percentage of fish age-6 years in the sample was 4.3 times greater off Washington and Oregon than off Vancouver Island. However there were 3 times the percentage of fish older than age-10 off the west coast of Vancouver Island. Clearly, hake off Washington and Oregon in this sample were younger than found off the west coast of Vancouver Island. At present it is not apparent why fish from the same year-class were smaller off Washington and Oregon than off British Columbia other than the obvious statement that larger fish no matter what age migrate further north in the spring and summer.

Mortality rates were estimated for the combined catches off the southwest coast of Vancouver Island and off the coast of Washington and Oregon. It is apparent from the catch curves (Tables 7, 11) that annual recruitment is not constant and that strong year-classes are an important component of this population. A total annual mortality rate of $A = 0.37$ was obtained for ages 9-17 from the slope of the descending limbs of the catch curve. This is similar to the annual mortality rate reported by Beamish (1981).

WALLEYE POLLOCK--All Areas

Walleye pollock were present in the catch from 24 of the 26 sets made in the Strait of Georgia. While no large catches were obtained, the series of horizontal sets (Table 5) indicated that some pollock may be distributed throughout the Strait of Georgia at most depths at this time of year.

Pollock were small, ranging in size from 38-50 cm with modal lengths at 38 cm for males and females. Males were more numerous in the catches than females, representing 67% of the 2,228 pollock sampled for length and sex (Table 13; sets 1-11, 29-43). Gonads from adult pollock were fully recovered from spawning. Two percent of the 107 pollock examined for maturity were immature.

In Juan de Fuca Strait small catches of pollock ranging in length from 22-46 cm were obtained in 4 of the 5 sets. The size range and the modal size was similar to that observed in the Strait of Georgia pollock (Table 13, sets 20-24). However, because catches were small it is difficult to compare growth, size or sex ratios with pollock found in other areas.

No pollock were found off the west coast of the United States. In the Canadian zone off the west coast of Vancouver Island pollock were present in 6 of the 7 sets and were abundant in set 27 (Table 1).

Pollock ranged in length from 18-59 cm but few fish larger than 45 cm were found. Those that were larger were mostly females (Table 14). The length frequency distribution of all pollock sampled from the catches off the west coast of Vancouver Island indicated that modes occurred at approximately 24, 36 and 40 cm, in both males and females (Table 14).

Of the 995 fish sampled for sex, 54% were females, indicating the ratio of males to females was about equal. All mature fish had fully recovered from spawning. One sample of 197 pollock was examined for maturity and 31% were found to be immature. Set 25 contained only small pollock that were probably in their 2nd year of growth (age-1+).

Ages were determined from a sample of 197 pectoral fins. Ages were first determined in March 1977 and reread in December 1979 by a second reader. The second determinations were identical to 59% of the first determintions, 4% were 1 year lower, 30% were 1 year higher and 6% were two years higher. The 30% increase in determinations by one year resulted in part from problems of idenitifying the first annulus. Since the identification of the first annulus using the fin-ray method can be difficult (Beamish 1979) and because the second reading was completed 2 years after the first reading when readers had more experience with the method, the second reading was considered to be more reliable.

Since growth was evident beyond the annulus, fish were aged as having plus (+) growth. Most fish ranged in age from 1+ to 5+ years with age 3+ fish being the dominant age-group (Fig. 7). Ten of the 21 females age-2+ were immature while 12% of the age-3+ females were immature indicating that most female pollock mature during their third year of life or age-2+. It was

more difficult to determine if males were maturing for the first time or had recently spawned hence no estimate of average age at first maturity was made.

Annual growth in length is reduced at the time of first maturity (Fig. 7). Assuming most fish spawn at age-3, it is apparent that the mortality rate is high after spawning and only a few fish spawn a second and third time. It is known that pollock older than 5 years exist in unexploited stocks and since there has not been a directed fishery for pollock in this area one might expect more age groups to be present. Ageing errors seem an unlikely explanation since the fin-ray method is particularly good at detecting older fish. It is possible that pollock in this area migrate here in the summer months and are being fished in some other area or that the older pollock no longer migrate into this area. It is also possible that the incidental catch of pollock in the hake fishery is sufficient to reduce the number of age groups.

SPINY DOGFISH--All Areas

Dogfish were present in 34 of the 43 tows and accounted for 13% of the total catch by weight. A total of 3,409 dogfish were measured, 2,173 from the Strait of Georgia and 1,436 from Juan de Fuca Strait and off the southwest coast of Vancouver Island (Table 15). No dogfish were caught off the Washington or Oregon coasts. Most of the dogfish (88%) found in the midwater tows were smaller than 60 cm.

In the Strait of Georgia, dogfish were present in 25 of the 26 sets. The two largest catches (sets 20,24) occurred at depths of less than 40 m.

AGE AND GROWTH

Samples of spines for age determinations were collected from all (943) dogfish caught from sets 31-43 (Table 15). Spines with annuli which formed ridges and were darkly pigmented were most easily distinguished. However, some annuli were not elevated from the spine surface and tended to form less distinct bands. Also, the method of estimating age from worn spines (Ketchen 1975) introduces an unknown error. Because of these difficulties and because the method has not been validated for all age classes in the population, ages determined from spines must be considered to be estimates.

Ages determined for the total sample in the Strait of Georgia (Fig. 8; Table 16) indicated that 87% of the sample was $\leq$10 years old. Fish of mean size smaller than 60 cm ranged in average age from 1-16 years. Mean annual increments were approximately 2 cm for the first 5 years of growth and 1.5 cm for subsequent years. There was no obvious difference in the average sizes of similar-aged male and female dogfish (Fig. 9; Tables 17, 18). There was some indication that dogfish found below 150 m (average depth of plankton layers) were slightly larger than similar age dogfish found above this layer

(Fig. 10; Tables 19, 20). A comparison of the number of fish aged ≤20 years present in all tows from various depth intervals clearly showed that most dogfish in their first few years are found at depths less than 60 m during July, and that more older fish are found at greater depths (Fig. 11). This would be expected since there is a relationship between age and size, and a greater percentage of larger fish are found in deeper waters (Fig. 12, 13).

The differences in mean size are not large. While this is partly related to the reduced amount of annual growth, there may be problems obtaining representative samples and there certainly are problems obtaining accurate measurements of length. Most dogfish were measured to the nearest mm in a relaxed state following death. This was accomplished by putting dogfish in tubs of water immediately. Even with such precautions, some dogfish had to be forcibly straightened prior to measuring. When this is done dogfish can be stretched 1-2 cm and such differences in length could represent one year's growth.

Modes determined from a length frequency distribution were compared with mean lengths estimated from the age determination studies for the various age-groups. Modes were determined using the probit analyses of Cassie (1954) and using a running average of 3, 5 and 7's. The total catch of dogfish from the Strait of Georgia and from the combined catches in Juan de Fuca Strait and off the southwest coast of Vancouver Island were analyzed separately. In both areas large catches were made of dogfish smaller than 50 cm, but a greater percent of dogfish smaller than 35 cm were found in the Juan de Fuca-southwest Vancouver Island area (Fig. 14).

Inflection points could be identified, but were only obvious for the first few years. If all inflection points were counted as a modal size for a year class then much slower mean annual growth was indicated by length frequency analysis than observed from the growth curves obtained from estimated ages (Fig. 15). If any strong inflection points were counted, modal and mean lengths were similar for the first 3 years. After age-3, the modal length for the next 4 age-classes was considerably longer than determined from the estimates of age using spines. The slope of the growth curve determined using strong inflection points for fish age-7 and older was similar to the slope determined using estimated ages indicating that except for ages 3-7 annual estimates of amount of growth were similar using these two methods.

Smoothing the length frequency distribution measured in mm (Fig. 16) from the Strait of Georgia using running averages of 3's, 5's and 7's did not substantially alter the interpretation provided by the probit analysis. Smoothing the length-frequency distribution of dogfish caught in Juan de Fuca Strait and South West Vancouver Island (Fig. 17) by running averages of 3's and 5's did facilitate the identification of modes for the smaller fish. If these modes represent the mean sizes of age-classes up to 5 years then annual amount of growth of dogfish in these areas is less than observed in the Strait of Georgia.

There is little doubt that dogfish grow slowly. Both the age determination methods using spines and length-frequency analysis indicate the annual amount of growth may be 1-2 cm for young fish and about 1 cm for older fish. This slow growth, the problems of measuring length, the possibility of different rates of growth of stocks and subsequent mixing of stocks over the

apparent long life span undoubtedly contribute to the difficulty interpreting the modes in the length frequency distribuiton. Intuitively and empirically it would appear that validation of age estimates can not be accomplished by length frequency analysis and another method involving the marking and recapture of specimens must be undertaken.

MORTALITY RATES OF JUVENILE DOGFISH

Mortality rates were estimated for juvenile dogfish by combining the age determinations in this study with the age determinations from samples collected in the same area in June 1976 (Beamish, unpublished). Mortality rates were estimated from the slope of the catch curve, however the assumption that the decrease in the number of older age groups is the result of mortalities and not emigration may not be correct. While the term mortality rate will be used, a more accurate description would be the rate of decrease in abundance of juveniles from the sampling area.

A total of 1,836 observations of fish age $\leq$27 years were used (Table 21; Fig. 18). Forty-five fish older than 27 years were not included. The growth curve $Y = 18.0 X + 306.7$ was fitted by the least squares method for ages 5-27 years ($r = 0.99$). The growth curve estimated by Ketchen (1975) for female dogfish in the Strait of Georgia has been included in Fig. 18. Ketchen's curve indicates a faster rate of growth for fish up to the age of about 15 resulting in fish of similar age being approximately 10 cm larger after age-15. Since Ketchen's (1975) curve is based on a sample of approximately 100 females and only spines with well-defined annuli were used it is possible this curve is biased towards faster-growing individuals.

Mortality rates from the catch curve (Fig. 19; Table 22) were calculated separately for ages 1-4, 5-19, 20-27 and 1-27 inclusive. The estimate for ages 1-27 was calculated according to the method of Robson and Chapman (1961). Annual survival rates ranged from $S = 0.70$ to 0.84 or a mortality rate of 16 to 30% per year. The mortality rate was higher for the first few years and after age-5 became more constant. The values of $Z = 0.19$, $S = 0.83$, $A = 0.17$ for ages 1-27 appear to be the best estimates of mortality and survival rates.

DISTRIBUTION AND FEEDING

The location of a plankton scattering layer was estimated for all sets. This layer was not always distinct, not always at the same depth and sometimes consisted of more than one layer. Thus the estimates of its location are somewhat qualitative. Midwater catches of dogfish were consistently in or above this layer. While this indicates a preference for the shallower water at this time of year, the reason for this preference is unknown at this time. Dogfish captured in the series of horizontal tows in the Strait of Georgia, (Table 5) also showed a preference for the shallow waters, although some juveniles were found at all depths.

Even though the catches of dogfish were small (Table 5) in the day and night trawling experiments it did appear that juveniles move toward the suface in the evening.

Seventy-six dogfish from sets 10 and 11 in the Strait of Georgia were examined for stomach contents. Plankton, particularly ctenophores, occurred in 93% of the stomachs, 4% contained fish remains and 3% were empty.

OTHER SPECIES

Other species were sampled (Table 23) if time was available.

Brown catsharks were present in the catch from 6 of the deeper sets (160-366 m) in the Strait of Georgia. They ranged in length from 22-59 cm and 60% were males (Table 24). Stomach contents were difficult to determine macroscopically but some glass shrimp were found in two of the 6 stomachs examined.

Five species of salmon ranging in length from 14-62 cm were found in 10 of the sets (Table 25). Seventy percent of the salmon were caught in the Strait of Georgia, 17% in Juan de Fuca Strait and 2% in the offshore areas. Seventy percent (42 fish) of the fish were coho, 23% (14 fish) were chinook, 3% (2 fish) were sockeye and 2% (1 fish each) were chum and pink salmon.

Length frequencies have been included for yellowtail rockfish and widow rockfish (Table 26). A random sample of herring and eulachon was measured for length-frequency from one tow (tow 25) in the offshore area (Table 27). Sixteen Jack mackerel were measured for length from one tow off the Oregon coast (Table 27).

Three Pacific lamprey and one river lamprey were present in 4 of the tows (Table 28). Three individuals were captured in the Strait of Georgia and one was caught on the Finger Bank off the southwest coast of Vancouver Island.

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Table 1. Species composition.

Set no.	1		2		3		4		5	
Estimated total catch (kg)	355		644		9,316		218		81	
Duration (min.)	15		30		30		30		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	221	532[a]	621	1,341[a]	9,080[b]	20,586[a]	10	18	22	126
Walleye pollock	115	242	14	29	180	412	171	381	20	37
Spiny dogfish	14	5	8	48	46	12	32	8	32	62
Brown cat shark										
Ratfish										
Northern smoothtongue									0.5	-
Northern lampfish									0.3	-
California headlightfish										
Northern anchovy										
Eulachon										
Pacific herring										
Chinook salmon	1	1			5	1	5	3		
Chum salmon										
Coho salmon	2	1							0.015	1
Pink salmon										
Sockeye salmon	0.1	1								
Pacific lamprey							0.1	1		
River lamprey										
Pallid eelpout									-	2
Wattled eelpout										
Tadpole snailfish										
Unknown sculpin										
Blackfin sculpin									-	1
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	1		2		3		4		5	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish									6	3
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish										
Sharpchin rockfish										
Widow rockfish										
Yellowtail rockfish	2	1			5	3				
Arrowtooth flounder										
Glass shrimp									.05	-
Squid			1	2						
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	6		7		8		9		10	
Estimated total catch (kg)	733		1,189		488		850		88	
Duration (min.)	45		18		30		30		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	420	908[a]	1,144	2,660	470	1,052[a]	804[b]	2,242[a]	35	176
Walleye pollock	296	287	37	86	16	20	28	57	12	26
Spiny dogfish	17	8	8	8			18	12	34	61
Brown cat shark									3	6
Ratfish										
Northern smoothtongue									0.3	-
Northern lampfish									0.04	8
California headlightfish										
Northern anchovy										
Eulachon										
Pacific herring										
Chinook salmon										
Chum salmon										
Coho salmon										
Pink salmon										
Sockeye salmon										
Pacific lamprey										
River lamprey										
Pallid eelpout										
Wattled eelpout										
Tadpole snailfish									0.01	11
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	6		7		8		9		10	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish									2	2
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish									1	1
Sharpchin rockfish										
Widow rockfish										
Yellowtail rockfish					1	1				
Arrowtooth flounder										
Glass shrimp									0.05	-
Squid					0.5	1			1	3
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	11		12		13		14		15	
Estimated total catch (kg)	51		192		164		3,646		916	
Duration (min.)	30		20		35		30		11	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	34	165	160	121	152	128	3,263[b]	2,375[a]	914	716
Walleye pollock	12	24	0.5	1	9	19	208	404		
Spiny dogfish	4	15	19	18						
Brown cat shark										
Ratfish										
Northern smoothtongue	0.05	-								
Northern lampfish	-	1								
California headlightfish										
Northern anchovy										
Eulachon										
Pacific herring										
Chinook salmon										
Chum salmon										
Coho salmon										
Pink salmon										
Sockeye salmon										
Pacific lamprey										
River lamprey										
Pallid eelpout										
Wattled eelpout										
Tadpole snailfish										
Unknown sculpin	-	1								
Blackfin sculpin										
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	11		12		13		14		15	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish										
Jack mackerel										
Bocaccio							1	1		
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish										
Sharpchin rockfish										
Widow rockfish			1	1						
Yellowtail rockfish			11	7	3	3	174	100[b]	2	2
Arrowtooth flounder										
Glass shrimp	0.03	-								
Squid	-	1								
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	16		17		18		19		20	
Estimated total catch (kg)	391		845		54		2,746		1,893	
Duration (min.)	30		37		30		30		90	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	391	338	843	1,029	53	-			906[b]	1,006[a]
Walleye pollock									50	109
Spiny dogfish									900[b]	1,227
Brown cat shark										
Ratfish										
Northern smoothtongue										
Northern lampfish										
California headlightfish										
Northern anchovy									1	75
Eulachon	0.1	4	-	1						
Pacific herring									18	-
Chinook salmon									7	4
Chum salmon										
Coho salmon									7	4
Pink salmon									0.5	1
Sockeye salmon										
Pacific lamprey										
River lamprey										
Pallid eelpout										
Wattled eelpout										
Tadpole snailfish										
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	16		17		18		19		20	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish									1	1
Jack mackerel							40	16		
Bocaccio										
Canary rockfish			2	1			2	-		
Pygmy rockfish							1	-		
Redstripe rockfish					1	-	1	-		
Rougheye rockfish										
Sharpchin rockfish					0.1	1	1	-		
Widow rockfish							2,600	-	0.5	1
Yellowtail rockfish							100	-	1	1
Arrowtooth flounder									1	1
Glass shrimp										
Squid										
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star							1	-		

Table 1 (cont'd)

Set no.	21		22		23		24		25	
Estimated total catch (kg)	134		2		347		3,207		167	
Duration (min.)	30		30		50		30		55	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake					292	301	454	-	23	14
Walleye pollock	3	11			38	87	68	-	14	48
Spiny dogfish	92	92			14	57	2,679	-	46	30
Brown cat shark										
Ratfish										
Northern smoothtongue										
Northern lampfish										
California headlightfish										
Northern anchovy										
Eulachon	33	-							46	-
Pacific herring	1	14							36	-
Chinook salmon	3	1					1	1		
Chum salmon										
Coho salmon			2	7			5	4		
Pink salmon										
Sockeye salmon										
Pacific lamprey										
River lamprey										
Pallid eelpout										
Wattled eelpout										
Tadpole snailfish										
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod	2	1								
Pacific cod									1	1

Table 1 (cont'd)

Set no.	21		22		23		24		25	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish										
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish										
Snarpchin rockfish										
Widow rockfish										
Yellowtail rockfish					3	2			1	1
Arrowtooth flounder										
Glass shrimp										
Squid										
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	26		27		28		29		30	
Estimated total catch (kg)	48		3,333		391		154		95	
Duration (min.)	30		30		30		45		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake			2,453[b]	1,828[a]	231	180			68	191
Walleye pollock			806	1,576	128	233				
Spiny dogfish	10	4	41	20	26	13	153	698	26	77
Brown cat shark										
Ratfish										
Northern smoothtongue										
Northern lampfish										
California headlightfish										
Northern anchovy										
Eulachon	~6	-								
Pacific herring	~6	-			1	-				
Chinook salmon	1	1								
Chum salmon										
Coho salmon							1	7		
Pink salmon										
Sockeye salmon										
Pacific lamprey			0.01	1						
River lamprey							0.01	1		
Pallid eelpout										
Wattled eelpout										
Tadpole snailfish										
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod							0.01	1		
Pacific cod										

Table 1 (cont'd)

Set no.	26		27		28		29		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish										
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish			5	6						
Rougheye rockfish										
Sharpchin rockfish										
Widow rockfish			1	4	0.5	1				
Yellowtail rockfish	25	-	27	-	4	3				
Arrowtooth flounder										
Glass shrimp										
Squid									0.5	1
Octopus										
Jellyfish										
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	31		32		33		34		35	
Estimated total catch (kg)	136		56		120		152		557	
Duration (min.)	35		30		30		30		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	72	257	47	245	65	213	68	237	532	1,270[a]
Walleye pollock	50	108	2	3	11	25	28	64	13	40
Spiny dogfish	11	31	5	8	36	70	17	21	11	29
Brown cat shark			0.5	1	5	10	7	21	0.5	1
Ratfish							25	-		
Northern smoothtongue	1	-	0.2	-	0.6	-	2	-		
Northern lampfish			0.04	4	0.1	29	0.4	40		
California headlightfish			0.01	1	0.04	2	0.02	2		
Northern anchovy										
Eulachon										
Pacific herring										
Chinook salmon					0.1	1				
Chum salmon										
Coho salmon										
Pink salmon										
Sockeye salmon										
Pacific lamprey	0.04[b]	2							0.2	1
River lamprey										
Pallid eelpout			0.05	2	0.01	2	0.1	31		
Wattled eelpout										
Tadpole snailfish			0.05	4	0.02	5	0.05	8		
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	31		32		33		34		35	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish										
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish										
Sharpchin rockfish										
Widow rockfish										
Yellowtail rockfish										
Arrowtooth flounder										
Glass shrimp	0.5	-	0.5	-	2	-	2	-		
Squid	1	2	0.5	1	0.5	-	2	-		
Octopus										
Jellyfish			0.3	1			0.5	1		
Anemones										
Starfish										
Brittle star										

Table 1 (cont'd)

Set no.	36		37		38		39		40	
Estimated total catch (kg)	67		122		74		116		189	
Duration (min.)	30		30		30		30		30	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	21	44			34	130	45	166		
Walleye pollock	44	93			32	65	34	66		
Spiny dogfish	1	11	118	313	7	14	32	64	189	533
Brown cat shark							2	8		
Ratfish							1	2		
Northern smoothtongue							0.1	-		
Northern lampfish	0.02	2			0.02	2	0.1	29		
California headlightfish	0.03	4			0.01	1	0.01	1		
Northern anchovy										
Eulachon										
Pacific herring										
Chinook salmon			0.2	2						
Chum salmon			0.1	1						
Coho salmon			1.4	23						
Pink salmon										
Sockeye salmon	0.1	1								
Pacific lamprey										
River lamprey										
Pallid eelpout										
Wattled eelpout							0.06	1		
Tadpole snailfish					0.01	1				
Unknown sculpin										
Blackfin sculpin										
Ribbon barracudina										
Lingcod										
Pacific cod										

Table 1 (cont'd)

Set no.	36		37		38		39		40	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish										
Jack mackerel										
Bocaccio										
Canary rockfish										
Pygmy rockfish										
Redstripe rockfish										
Rougheye rockfish										
Snhrpchin rockfish										
Widow rockfish										
Yellowtail rockfish										
Arrowtooth flounder										
Glass shrimp										
Squid	1	3			1	5	1	5		
Octopus							0.1	1		
Jellyfish										
Anemones							0.5	1		
Starfish							+[c]	+		
Brittle star										

Table 1 (cont'd)

Set no.	41		42		43		Totals[d]	
Estimated total catch (kg)	331		57		81		Total weighed 34,792	Total counted 50,404
Duration (min.)	30		30		30			
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Pacific hake	278	546[a]	32	114	41	123	24,299	41,378
Walleye pollock	33	66	22	44	27	52	2,522	4,715
Spiny dogfish	20	16	1	5	12	34	4,679	3,624
Brown cat shark					0.7	1	18.7	48
Ratfish							26	2
Northern smoothtongue			0.1	+	+	+	5	-
Northern lampfish			0.06	6	+	+	1.08	121
California headlightfish					+	+	0.12	11
Northern anchovy							1	75
Eulachon							85.1	-
Pacific herring							62	-
Chinook salmon							23.3	15
Chum salmon							0.1	1
Coho salmon							18.5	47
Pink salmon							0.5	1
Sockeye salmon							0.2	2
Pacific lamprey							0.35	5
River lamprey							0.01	1
Pallid eelpout			0.2	29			0.36	66
Wattled eelpout							0.06	1
Tadpole snailfish			0.08	40			0.22	69
Unknown sculpin							+	1
Blackfin sculpin							+	1
Ribbon barracudina							0.3	3
Lingcod							2.01	2
Pacific cod							1	1

Table 1 (cont'd)

Set no.	41		42		43		Totals[d]	
Species	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
Sablefish							9	6
Jack mackerel							40	16
Bocaccio							1	1
Canary rockfish							4	1
Pygmy rockfish							1	-
Redstripe rockfish							7	6
Rougheye rockfish							1	1
Sharpchin rockfish							1.1	1
Widow rockfish							2,603	7
Yellowtail rockfish							359	124
Arrowtooth flounder							1	1
Glass shrimp			0.2	-	+	+	5.33	-
Squid			1	3	+	+	11	27
Octopus							0.1	1
Jellyfish							0.8	2
Anemones							0.5	1
Starfish							+	-
Brittle star							1	-

[a]Number of fish calculated from subsample.
[b]Estimated visually on deck.
[c]Present in catch.
[d]Totals do not represent total catches as weights and numbers were not available for all tows.

Table 2. Summary of hake sampled, July 13-29, 1976.

Set no.	Length		Total[a]	Maturity	Stomach contents	Otoliths	Sampling remarks[b]
	Male	Female					
1	185	134	319	103			Random-1 tub of 5, Random-2 tubs of 5.
2	104	147	251				L/S-1st 3 tubs of 16
3	211	115	326				3 tubs of est. 9,000 kg
4	-	-	-				Not sampled
5	26	35	126				Total catch
6	93	155	248				Random-3 tubs of 11
7	149	136	285				Random-3 tubs of 28
8	145	134	287	40	40		L/S/Mat/St-1 tub of 11, L/S-2 tubs of 11
9	212	142	354				Random-3 tubs of 19
10	58	62	176				Total catch
11	30	45	165				" "
12	22	99	121				" "
13	29	99	128				" "
14	81	239	320	320		320	Random-10 tubs of 74
15	124	217	341	341		341	1st 10 tubs of 21
16	157	181	338	338		338	Total catch
17	122	203	325	325		325	Random-6 tubs of 19
18	-	-	-				Not sampled
20	202	373	575	191		191	Random-L/S-12 tubs (~ ½ catch) Stratified L/S/ mat/oto at 10-cm intervals
23	93	208	301				Total catch

Table 2 (cont'd)

Set no.	Length		Total[a]	Maturity	Stomach contents	Otoliths	Sampling remarks[b]
	Male	Female					
24	-	-	-				Not sampled
25	2	12	14	14		14	Total catch
27	41	166	207	207		207	Random-L/S/Mat/Oto-6 tubs of 24. Also 24 large select L/S/mat/oto
28	46	134	180				Total catch
30	124	68	192	192		192	" "
31	57	95	257				" "
32	46	51	245				" "
33	66	108	213				" "
34	64	118	237				" "
35	139	134	293				Random-3 tubs of 13
36	19	25	44				Total catch
38	33	32	130				" "
39	52	77	166				" "
41	121	124	245				1st 3 tubs of 7
42	32	36	114				Total catch
43	43	66	123				" "

[a]Not all fish measured for length were sexed.

[b]L = length
S = sex
Mat = maturity
St = stomach contents
Oto = otoliths

Table 3. Length frequency of hake.

Fork length (cm)	1			2			3			5		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												3
11												5
12												12
13												21
14												12
15												6
16												6
17												
18												
19												
20												
21												
22											3	3
23										3	1	4
24										1	1	2
25										1	2	3
26	4		4							3	1	4
27		2	2							2	2	4
28	1	3	4								2	2
29	1	1	2							2	1	3
30		1	1							1		1
31												
32		2	2									
33	1		1									
34	4	1	5									
35	4	1	5	1		1						
36	3	4	7				4		4			
37	13	7	20	1		1	12	5	17	2		2
38	19	8	27	1		1	20	2	22			
39	17	11	28	4		4	25	11	36			
40	23	11	34	6	4	10	31	15	46			
41	23	17	40	11	10	21	26	20	46	2	3	5
42	15	12	27	14	14	28	18	13	31	2	1	3
43	21	10	31	15	12	27	21	10	31		3	3
44	15	12	27	18	33	51	22	9	31	1	3	4
45	8	14	22	15	25	40	14	9	23	3	2	5
46	9	10	19	8	24	32	8	4	12	2	3	5
47	2	2	4	6	10	16	4	6	10		3	3
48	2	1	3	3	7	10	3	3	6	1	2	3
49		3	3	1	5	6	3		3			
50					3	3		1	1		1	1
51								1	1			
52		1	1					1	1			
53												
54								1	1			
55												

Table 3 (cont'd)

Fork length (cm)	1			2			3			5		
	M	F	T	M	F	T	M	F	T	M	F	T
56								1	1			
57												
58											1	1
59												
60												
61								1	1			
62												
63												
64												
65								1	1			
66								1	1			
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
Total	185	134	319	104	147	251	211	115	326	26	35	126

Table 3 (cont'd)

Fork length (cm)	6			7			8			9		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												
11												
12												
13									1			
14									2			
15									5			
16												
17												
18												
19												
20												
21												
22												
23												
24												
25							2		2			
26											1	1
27										3		3
28												
29											1	1
30										3		3
31										4	2	6
32										2	4	6
33										6	6	12
34										5	11	16
35				2		2				7	9	16
36	1		1	4	1	5	1		1	29	13	42
37	1		1	6	4	10	1	2	3	23	12	35
38	4		4	11	7	18	12	2	14	27	23	50
39	5	1	6	12	11	23	10	10	20	29	13	42
40	3	8	11	22	19	41	10	7	17	29	14	43
41	5	9	14	18	15	33	14	18	32	13	10	23
42	10	14	24	15	15	30	20	20	40	11	7	18
43	14	14	28	15	13	28	24	16	40	7	6	13
44	11	19	30	20	13	33	15	14	29	6	3	9
45	19	23	42	13	9	22	11	15	26	5	4	9
46	10	16	26	8	12	20	6	12	18	3	2	5
47	7	17	24	2	10	12	11	7	18			
48	3	14	17		2	2	4	5	9		1	1
49		9	9		5	5	3		3			
50		4	4	1		1	1	3	4			
51		3	3									
52		3	3									
53		1	1									
54								1	1			
55								1	1			

Table 3 (cont'd)

Fork length (cm)	6			7			8			9		
	M	F	T	M	F	T	M	F	T	M	F	T
56												
57												
58								1	1			
59												
60												
61												
62												
63												
64												
65												
66												
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
Total	93	155	248	149	136	285	145	134	287	212	142	354

Table 3 (cont'd)

Fork length (cm)	10			11			12			13		
	M	F	T	M	F	T	M	F	T	M	F	T
9						1						
10			1			1						
11						12						
12			6			25						
13			16			26						
14			14			16						
15			8			7						
16			9			2						
17			2									
18												
19												
20												
21												
22	2		2	1		1						
23	4	1	5		1	1						
24	3	3	6		1	1						
25	4	6	10	2		2						
26	11	6	17		1	1						
27	7	3	10		5	5						
28	4	1	5	2	1	3						
29	3	3	6	1		1						
30				1	2	3						
31		1	1		2	2						
32	1		1		1	1						
33		1	1		1	1						
34					3	3						
35	1	1	2		3	3						
36					5	5						
37	1		1		4	4						
38	1	1	2	2	5	7						
39	1	3	4	2	2	4						
40	3		3	1	4	5						
41	2	4	6		1	1						
42	2	2	4	3		3						
43	2	1	3	4	1	5						
44	1	3	4	6	1	7						
45	3	6	9	3		3						
46	1	5	6	1		1	2		2		1	1
47		2	2	1		1				1	1	2
48		3	3				1	2	3	2	3	5
49							3	1	4		5	5
50	1	2	3					1	1	3	6	9
51		1	1				1	3	4	1	7	8
52		1	1				1	2	3	4	6	10
53							1	7	8	5	7	12
54							4	3	7	2	7	9
55							1	2	3	2	8	10

Table 3 (cont'd)

Fork length (cm)	10			11			12			13		
	M	F	T	M	F	T	M	F	T	M	F	T
56								8	8	2	4	6
57		1	1		1	1	3	4	7	3	8	11
58								4	4	1	6	7
59								11	11	1	1	2
60							1	10	11	1	4	5
61								11	11	1	7	8
62							2	6	8		6	6
63								7	7		4	4
64								7	7		1	1
65							1	6	7		4	4
66								1	1		1	1
67							1	2	3			
68								1	1		2	2
69												
70												
71												
72												
73												
74		1	1									
75												
76												
77												
78												
79												
80												
81												
Total	58	62	176	30	45	165	22	99	121	29	99	128

Table 3 (cont'd)

Fork length (cm)	14			15			16			17		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39				1		1						
40												
41							1		1		1	1
42							2	1	3			
43				1	2	3	3	1	4	1	1	2
44	1		1	3	2	5	7	6	13	1	1	2
45	2		2	14	9	23	9	10	19	7	8	15
46	1	2	3	6	17	23	21	14	35	12	10	22
47	4		4	18	26	44	15	22	37	9	14	23
48	9	7	16	21	36	57	25	23	48	19	26	45
49	6	9	15	18	36	54	21	16	37	8	16	24
50	6	7	13	11	23	34	13	23	36	16	22	38
51	6	10	16	13	24	37	12	19	31	14	17	31
52	7	13	20	8	13	21	12	6	18	17	16	33
53	8	20	28	5	5	10	6	11	17	6	17	23
54	7	14	21	3	10	13	3	2	5	4	16	20
55	7	17	24		2	2	1	6	7	7	12	19

Table 3 (cont'd)

Fork length (cm)	14			15			16			17		
	M	F	T	M	F	T	M	F	T	M	F	T
56	7	10	17	2	5	7	2	9	11	1	9	10
57	1	13	14		3	3	1	4	5		11	11
58	3	14	17				1	4	5		4	4
59	2	12	14		1	1	2	1	3			
60	2	17	19		2	2		1	1		1	1
61	1	19	20									
62		17	17					2	2			
63		7	7									
64	1	11	12		1	1						
65		6	6									
66		4	4									
67		4	4								1	1
68		2	2									
69		2	2									
70		1	1									
71												
72												
73		1	1									
74												
75												
76												
77												
78												
79												
80												
81												
Total	81	239	320	124	217	341	157	181	338	122	203	325

Table 3 (cont'd)

Fork length (cm)	20			23			25			27		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												
37												
38												
39												
40												
41					1	1						
42	1		1									
43	2		2		1	1						
44	6	1	7	2		2						
45	11	6	17	5	2	7					1	1
46	13	15	28	8	10	18						
47	25	16	41	10	17	27				1	1	2
48	27	32	59	5	20	25				1	8	9
49	19	36	55	9	19	28					1	1
50	20	38	58	13	16	29				5	4	9
51	16	42	58	14	20	34				1	7	8
52	23	27	50	2	17	19				2	4	6
53	6	29	35	7	13	20	1	1		2	7	9
54	9	28	37	3	9	12	1	1		4	10	14
55	10	14	24	2	10	12				3	6	9

Table 3 (cont'd)

Fork length (cm)	20			23			25			27		
	M	F	T	M	F	T	M	F	T	M	F	T
56	4	9	23	2	13	15	1		1	3	6	9
57	4	12	16	3	13	16				2	13	15
58	1	11	12	4	6	10				4	19	23
59	3	11	14	1	6	7		1	1	4	8	12
60	1	9	10	2	8	10	1	1	2	1	17	18
61		8	8	1	2	3		2	2		11	11
62		3	3		3	3		2	2	1	2	3
63		3	3					1	1		3	3
64		2	2		1	1		1	1		6(1)[a]	6(1)[a]
65								1	1		7(1)	7(1)
66		3	3							1(1)[a]	6(3)	7(4)
67	1	3	4							1(1)	3(1)	4(2)
68		2	2					1	1	1(1)	6(4)	7(5)
69		2	2		1	1				1(1)	4(2)	5(3)
70										1(1)	1(1)	2(2)
71												
72											3(2)	3(2)
73										1(1)		1(1)
74											1(1)	1(1)
75												
76												
77										1(1)	1	2(1)
78												
79												
80		1	1									
81											1(1)	1(1)
Total	202	373	575	93	208	301	2	12	14	41(7)	167(17)	208(24)

Table 3 (cont'd)

Fork length (cm)	28			30			31			32		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												
11									1			5
12				1		1			5			9
13									19			28
14				1		1			31			49
15					2	2			26			30
16				2	1	3			15			18
17									6			7
18									2			2
19												
20												
21								1	1			
22										2		2
23										1		1
24												
25							2	1	3	2	1	3
26							1	1	2	4		4
27				1		1		1	1			
28							2		2	1		1
29								1	1			
30												
31				2		2						
32							1		1			
33					2	2						
34				2	1	3						
35				6		6						
36				11	5	16	2	1	3			
37				8	6	14	1	1	2	1		1
38				19	10	29	2		2	2	1	3
39				9	3	12	4	3	7	5	2	7
40				24	11	35	4	3	7	3	3	6
41				11	11	22	5	9	14	5	3	8
42				7	4	11	11	7	18	5	3	8
43				7	4	11	3	11	14	1	5	6
44				5	4	9	7	11	18	4	8	12
45				2		2	6	13	19	3	4	7
46		3	3	4	1	5	3	10	13	5	6	11
47	2	2	4	2	2	4	3	10	13	1	3	4
48	3	5	8		1	1		4	4		3	3
49	6	5	11					3	3		5	5
50		5	5					3	3		2	2
51	8	6	14							1	1	2
52		8	8									
53	3	2	5					1	1			
54	3	8	11								1	1
55	6	9	15									

Table 3 (cont'd)

Fork length (cm)	28			30			31			32		
	M	F	T	M	F	T	M	F	T	M	F	T
56	3	11	14									
57	4	6	10									
58	2	6	8									
59	3	8	11									
60		15	15									
61	1	12	13									
62	1	4	5									
63	1	7	8									
64		5	5									
65		2	2									
66		2	2									
67		2	2									
68		1	1									
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
Total	46	134	180	124	68	192	57	95	257	46	51	245

Table 3 (cont'd)

Fork length (cm)	33			34			35			36		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												
11						1						
12			2			1			2			
13			4			8			6			
14			16			14			6			
15			11			19			6			
16			3			9						
17			2			3						
18			1									
19												
20												
21				3		3	1		1			
22				1	1	2						
23		2	2		4	4						
24	3	3	6	2	1	3						
25	3	5	8	5	8	13						
26	7	5	12	4	5	9	1		1			
27	1	5	6	6	4	10						
28	4	4	8	1		1						
29	3	1	4		1	1						
30	2		2		2	2						
31	2		2		4	4						
32					1	1						
33					1	1						
34				1		1						
35				1	1	2						
36	5		5	1		1		1	1			
37				1	1	2	3	1	4			
38	6	3	9	5	2	7	5	2	7			
39	3	3	6	3	5	8	8	7	15			
40	4	3	7	8	5	13	15	9	24	1	2	3
41	2	6	8	5	5	10	10	13	23	2	3	5
42	6	4	10	4	12	16	19	11	30	2	2	4
43	5	6	11	3	7	10	19	12	31	3	2	5
44	2	14	16	4	9	13	22	20	42	5	2	7
45	1	19	20	4	10	14	11	17	28	2		2
46	4	10	14		6	6	7	9	16	2	3	5
47	2	8	10	1	12	13	11	13	24	1	7	8
48		1	1	1	5	6	4	10	14	1	4	5
49	1	1	2		3	3	2	3	5			
50		2	2		1	1	1	3	4			
51					1	1		2	2			
52		1	1					1	1			
53		2	2									
54												
55												

Table 3 (cont'd)

Fork length (cm)	33			34			35			36		
	M	F	T	M	F	T	M	F	T	M	F	T
56												
57												
58					1	1						
59												
60												
61												
62												
63												
64												
65												
66												
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
Total	66	108	213	64	118	237	139	134	293	19	25	44

Table 3 (cont'd)

Fork length (cm)	38			39			41			42		
	M	F	T	M	F	T	M	F	T	M	F	T
9												
10												1
11			3			1						
12			5			1						1
13			8			11						3
14			16			9						12
15			15			6						10
16			9			5						10
17			8			2						5
18			1			1						4
19						1						
20												
21												
22				1		1						
23				1	2	3						
24	1		1	2	2	4				2	1	3
25		1	1	1	8	9					2	2
26	1		1	7	3	10						
27				5	5	10				1	2	3
28		2	2	3	5	8						
29				4	4	8				2		2
30					2	2						
31												
32												
33				1	1	2						
34					1	1						
35												
36												
37											2	2
38											2	2
39				1		1						
40												
41	2	1	3				1		1	1	1	2
42	2	3	5	2		2	9	4	13	1	2	3
43	7	2	9	7	1	8	17	4	21	2	1	3
44	2	1	3	9	3	12	26	8	34	6		6
45	8	3	11		13	13	23	14	37	4	2	6
46	7	8	15	3	7	10	18	19	37	5	5	10
47	2	5	7	5	5	10	15	19	34	7	7	14
48	1	3	4		8	8	6	23	29		3	3
49					3	3	3	17	20	1	1	2
50		1	1		1	1	1	9	10		4	4
51		1	1		1	1	1	2	3		1	1
52		1	1					2	2			
53							1	1	2			
54								2	2			
55					1	1						

Table 3 (cont'd)

Fork length (cm)	38			39			41			42		
	M	F	T	M	F	T	M	F	T	M	F	T
56					1	1						
57												
58												
59												
60												
61												
62												
63												
64												
65												
66												
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
Total	33	32	130	52	77	166	121	124	245	32	36	114

Table 3 (cont'd)

Fork length (cm)	43		
	M	F	T
9			
10			
11			
12			
13			1
14			3
15			7
16			2
17			1
18			
19			
20			
21			
22			
23	2		2
24	1	1	2
25	3	3	6
26	2	2	4
27	1	6	7
28	3	2	5
29		3	3
30	1	1	2
31		3	3
32		1	1
33			
34			
35			
36			
37		1	1
38	8		8
39	1	1	2
40		1	1
41	1	1	2
42			
43	4	2	6
44	5	7	12
45	4	9	13
46	3	7	10
47	1	8	9
48	2	6	8
49	1	1	2
50			
51			
52			
53			
54			
55			

Table 3 (cont'd)

Fork length (cm)	43		
	M	F	T
56			
57			
58			
59			
60			
61			
62			
63			
64			
65			
66			
67			
68			
69			
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
80			
81			
Total	43	66	123

[a]Selected fish: have been included in the length frequency.

Table 4. Mean size of Pacific hake for each age group from set 30 using the surface and sections of otoliths. (Sample size in parentheses.)

	Surface age			Section age		
Age	Male	Female	Total	Male	Female	Total
1	14.0 (2)	15.0 (1)	14.3 (3)	14.5 (4)	15.3 (3)	14.9 (7)
2	26.7 (7)	21.3 (3)	25.4 (10)	29.0 (2)	33.0 (1)	30.3 (3)
3	36.9 (24)	37.4 (20)	37.2 (44)	36.7 (29)	37.9 (25)	37.3 (54)
4	39.1 (42)	40.1 (22)	39.5 (64)	39.1 (55)	40.4 (26)	39.5 (81)
5	40.0 (26)	41.4 (14)	40.5 (40)	40.4 (12)	42.9 (7)	41.3 (19)
6	41.7 (9)	42.4 (3)	41.8 (12)	43.6 (5)	41.0 (3)	42.6 (8)
7	43.8 (6)	44.0 (3)	43.7 (9)	42.0 (1)		42.0 (1)
8	44.8 (5)	46.0 (1)	45.0 (6)	45.0 (1)	48.0 (1)	46.5 (2)
9	45.5 (2)		45.5 (2)			
10	46.0 (1)	44.0 (1)	46.5 (2)	43.0 (3)		43.0 (3)
11						
12				44.4 (5)	47.0 (1)	44.8 (6)
13				45.0 (3)		45.0 (3)
14				44.0 (1)		44.0 (1)
15				47.0 (1)		47.0 (1)
16						
17				41.0 (1)	46.0 (1)	43.5 (2)
18						
19				46.0 (1)		46.0 (1)
Total	124	68	192	124	68	192

Table 5. Catch of Pacific hake, walleye pollock, spiny dogfish from a series of day and night sets and a series of horizontal tows.

Set no.	Average bottom depth (m)	Average net depth (m)	Duration	Start time	Catch kg/30 min.		
					Pacific hake	Walleye pollock	Spiny dogfish
6	165	73	45	1330 (D)	280	197	11
7	178	90	18	1548 (D)	1,906	62	13
8	190	91	30	2223 (N)	470	16	0
9	198	36	30	2345 (N)	804	28	18
37	364	11	30	1945	0	0	118
36	379	112	30	1720	21	44	1
32	384	155	30	1020	47	2	5
35	320	220	30	1525	532	13	11
33	366	293	30	1145	65	11	36
34	366	390	30	1340	68	28	17
40	339	12	30	1150	0	0	189
41	312	112	30	1300	278	33	20
38	355	165	30	0900	34	32	7
42	355	227	30	1425	32	22	1
43	350	278	30	1600	41	27	12
39	334	294	30	1020	45	34	32

D = Day; N = Night

Table 6. Length frequency of a random sample of Pacific hake from approximately one half of the total catch (set 20) from the Strait of Juan de Fuca.

Fork length (cm)	Males	Females	Total
42	1		1
43	2		2
44	6	1	7
45	11	6	17
46	13	15	28
47	25	16	41
48	27	32	59
49	19	36	55
50	20	38	58
51	16	42	58
52	23	27	50
53	6	29	35
54	9	28	37
55	10	14	24
56	4	19	23
57	4	12	16
58	1	11	12
59	3	11	14
60	1	9	10
61		8	8
62		3	3
63		3	3
64		2	2
65			
66		3	3
67	1	3	4
68		2	2
69		2	2
=			
=			
81		1	1
Total	202	373	575

Table 7. Mean size of Pacific hake for each age group from the Strait of Juan de Fuca (set 20) using the surface and sections of otoliths. (Sample size in parentheses.)

	Surface age			Section age		
Age	Male	Female	Total	Male	Female	Total
3		45.0 (1)	45.0 (1)	43.5 (4)	45.0 (3)	44.1 (7)
4	43.5 (2)	45.0 (1)	44.0 (3)	43.5 (4)	45.0 (3)	44.1 (7)
5	43.3 (3)	44.7 (3)	44.0 (6)	52.0 (1)	55.6 (8)	54.9 (10)
6	47.5 (10)	52.0 (15)	50.2 (25)	48.6 (26)	50.4 (40)	49.6 (67)
7	50.1 (22)	51.0 (30)	50.7 (52)	50.9 (9)	52.0 (14)	52.0 (26)
8	50.6 (11)	52.8 (27)	52.3 (38)	57.0 (2)	58.4 (11)	58.5 (12)
9	53.3 (7)	54.1 (16)	53.9 (23)	53.8 (5)	57.5 (14)	56.7 (20)
10	54.0 (3)	60.2 (17)	59.3 (20)	56.0 (3)	59.0 (10)	58.3 (13)
11	59.0 (1)	61.5 (8)	61.2 (9)	54.0 (1)	61.0 (1)	57.5 (2)
12		60.3 (6)	60.3 (6)	54.5 (2)	63.0 (8)	61.3 (10)
13		65.6 (5)	65.6 (5)	59.0 (1)	67.5 (2)	64.7 (3)
14				57.0 (1)	64.3 (4)	62.8 (5)
15	67.0 (1)	69.0 (1)	68.0 (2)		60.8 (4)	60.8 (4)
16					61.8 (4)	61.8 (4)
17				67.0 (1)		67.0 (1)
Total	60	130	190	61	130	191

Table 8. Length frequency of Pacific hake found off the west coast of Vancouver Island.

Fork length (cm)	Set 12			Set 13			Set 14			Set 25			Set 27			Set 28			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
44							1		1										1		1
45							2		2					1	1				2	3	5
46	2		2		1	1	1	2	3								3	3	3	6	9
47				1	1	2	4	0	4				1	1	2	2	2	4	8	4	12
48	1	2	3	2	3	5	9	7	16				1	8	9	3	5	8	16	25	41
49	3	1	4		2	2	6	9	15					1	1	6	5	11	15	18	33
50		1	1	3	6	9	6	7	13				5	4	9		5	5	14	23	37
51	1	3	4	1	7	8	6	10	16				1	7	8	8	6	14	17	33	50
52	1	2	3	4	6	10	7	13	20				2	4	6		8	8	14	33	47
53	1	7	8	5	7	12	8	20	28		1	1	2	7	9	3	2	5	19	43	62
54	4	3	7	2	7	9	7	14	21		1	1	4	10	14	3	8	11	20	42	62
55	1	2	3	2	8	10	7	17	24				3	6	9	6	9	15	19	42	61
56		8	8	2	4	6	7	10	17	1		1	3	6	9	3	11	14	16	39	55
57	3	4	7	3	8	11	1	13	14				2	13	15	4	6	10	13	44	57
58		4	4	1	6	7	3	14	17				4	19	23	2	6	8	10	49	59
59		11	11	1	1	2	2	12	14		1	1	4	8	12	3	8	11	10	41	51
60	1	10	11	1	4	5	2	17	19	1	1	2	1	17	18		15	15	6	64	70
61		11	11	1	7	8	1	19	20		2	2		11	11	1	12	13	3	62	65
62	2	6	8		6	6		17	17		2	2	1	2	3	1	4	5	4	37	41
63		7	7		4	4		7	7		1	1		3	3	1	7	8	1	29	30
64		7	7		1	1	1	11	12		1	1		6	6		5	5	1	30	31
65	1	6	7		4	4		6	6		1	1		7	7		2	2	1	26	27
66		1	1		1	1		4	4				1	6	7		2	2	1	14	15
67	1	2	3					4	4				1	3	4		2	2	2	11	19
68		1	1		2	2		2	2		1	1	1	6	7		1	1	1	13	20
69								2	2				1	4	5				1	6	9
70								1	1				1	1	2				1	2	4
71																					
72														3	3					3	3
73								1	1				1		1				1	1	3
74														1	1					1	1

Table 8 (cont'd)

Fork length (cm)	Set 12			Set 13			Set 14			Set 25			Set 27			Set 28			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
75																					
76																					
77													1	1	2				1	1	2
78																					
79																					
80																					
81														1	1					1	1
Total	22	99	121	29	96	125	81	239	320	2	12	14	41	167	208	46	134	180	221	747	968

Table 9. Mean size of Pacific hake for each age group from sets made off the west coast of Vancouver Island. (Sample size in parentheses.)

Age	Surface age						Section age		
	Set 14			Set 27			Set 27		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
4	45.0 (1)		45.0 (1)				50.0 (1)		50.0 (1)
5		52.0 (2)	52.0 (2)	53.0 (1)		53.00 (1)		52.0 (1)	52.0 (1)
6	50.8 (12)	54.3 (28)	53.3 (40)	53.0 (5)	54.4 (17)	54.0 (22)	52.5 (8)	53.5 (30)	53.3 (38)
7	50.5 (28)	53.2 (57)	52.3 (85)	53.6 (7)	53.0 (21)	53.1 (28)	50.0 (1)	53.5 (11)	53.2 (12)
8	52.2 (19)	57.8 (36)	55.8 (55)	55.7 (9)	56.9 (36)	56.6 (45)	53.0 (4)	58.2 (17)	57.2 (21)
9	56.0 (12)	58.4 (48)	58.8 (60)	58.3 (3)	58.9 (32)	58.8 (35)	61.0 (9)	59.3 (38)	59.6 (47)
10	57.5 (8)	59.9 (20)	59.2 (28)	54.3 (7)	58.6 (16)	57.3 (23)	55.5 (2)	58.6 (13)	58.1 (15)
11	52.0 (1)	61.2 (27)	60.8 (28)	52.0 (1)	60.4 (14)	59.8 (15)	62.5 (2)	60.0 (6)	60.6 (8)
12		59.9 (9)	59.9 (9)	58.0 (1)	62.3 (6)	61.7 (7)	63.0 (6)	63.3 (12)	63.2 (18)
13		64.1 (7)	64.1 (7)		63.0 (2)	63.0 (2)	62.0 (2)	64.4 (7)	63.9 (9)
14		64.0 (5)	64.0 (5)		61.6 (5)	61.6 (5)		59.0 (4)	59.0 (4)
15							55.3 (4)	62.4 (14)	60.8 (18)
16							53.0 (1)	58.8 (4)	57.6 (5)
17								67.3 (4)	67.3 (4)
Total	18	239	320	34	149	183	40	161	201

Table 10. Length frequency of Pacific hake found off the west coast of Washington and Oregon.

Fork length (cm)	Set 15			Set 16			Set 17			Total		
	M	F	T	M	F	T	M	F	T	M	F	T
39	1		1							1		1
40												
41				1		1		1	1	1	1	2
42				2	1	3				2	1	3
43	1	2	3	3	1	4	1	1	2	5	4	9
44	3	2	5	7	6	13	1	1	2	11	9	20
45	14	9	23	9	10	19	7	8	15	30	27	57
46	6	17	23	21	14	35	12	10	22	39	41	80
47	18	26	44	15	22	37	9	14	23	42	62	104
48	21	36	57	25	23	48	19	26	45	65	85	150
49	18	36	54	21	16	37	8	16	24	47	68	115
50	11	23	34	13	23	36	16	22	38	40	68	108
51	13	24	37	12	19	31	14	17	31	39	60	99
52	8	13	21	12	6	18	17	16	33	37	35	72
53	5	5	10	6	11	17	6	17	23	17	33	50
54	3	10	13	3	2	5	4	16	20	10	28	38
55		2	2	1	6	7	7	12	19	8	20	28
56	2	5	7	2	9	11	1	9	10	5	23	28
57		3	3	1	4	5		11	11	1	18	19
58				1	4	5		4	4	1	8	9
59		1	1	2	1	3				2	2	4
60		2	2		1	1		1	1		4	4
61												
62					2	2					2	2
63												
64		1	1								1	1
65												
66												
67								1	1		1	1
68												
69												
70												
Total	124	217	341	157	181	338	122	203	325	403	601	1004

Table 11. Mean size of Pacific hake for each age group using sections of otoliths from sets 15 and 17 off the coasts of Washington and Oregon. (Sample size in parentheses.)

Age	Male	Female	Total
3	43.0 (1)	45.9 (7)	45.5 (8)
4	44.0 (3)	46.6 (7)	45.8 (10)
5	48.8 (18)	49.3 (26)	49.1 (44)
6	48.4 (126)	49.2 (209)	48.9 (335)
7	48.1 (26)	49.6 (54)	49.1 (80)
8	50.0 (18)	52.1 (25)	51.2 (43)
9	51.7 (20)	53.1 (30)	52.5 (50)
10	52.4 (8)	53.4 (14)	53.0 (22)
11	51.6 (5)		51.6 (5)
12	50.8 (4)	54.4 (7)	53.1 (11)
13	53.0 (3)	55.8 (5)	54.8 (8)
14	51.0 (1)	51.6 (8)	51.5 (9)
15	50.4 (5)	55.0 (11)	53.6 (16)
16	51.5 (4)	54.3 (7)	53.3 (11)
17	51.7 (3)		51.7 (3)
Total	245	410	655

Table 12. Summary of pollock sampled, July 13-29, 1976.

Set no.	Length		Total	Maturity	Fins and scales	Sampling remarks[a]
	Male	Female				
1	172	70	242	107		Total catch-1 tub L/S/Mat, 2 tubs L/S
2	22	7	29			Total catch
3	282	130	412			" "
4	262	119	381			" "
5	22	14	36			" "
6	189	98	287			" "
7	62	24	86			" "
8	14	6	20			" "
9	38	19	57			" "
10	19	8	27			" "
11	16	9	25			" "
12	0	1	1			" "
13	6	13	19			" "
14	191	213	404			" "
20			110			" "
21	6	5	11			" "
23	52	35	87			" "
24						Not sampled
25	30	21	51			Total catch
27	134	153	287	197	197	Random-3 tubs of 1b, 1 tub L/S, 2 tubs L/S/Mat/Age
28	101	132	233			Total catch
31	71	37	108			Total catch
32	1	2	3			" "
33	18	7	25			" "
34	52	12	64			" "
35	31	9	40			" "
36	53	40	93			" "
38	37	28	65			" "
39	35	31	66			" "
41	44	22	66			" "
42	23	21	44			" "
43	23	29	52			" "

[a] L = length
S = sex
Mat = maturity
Age = fins and scales.

Table 13. Length frequency of pollock.

Fork length (cm)	Set no. 1			2			3			4			5		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28								1	1						
29															
30										1		1			
31							1		1	5	2	7			
32	1	1	2				1	1	2	1	2	3			
33	11	1	12	1		1	7		7	8	4	12			
34	15		15	1		1	14	2	16	12	4	16			
35	8	3	11	3		3	24	10	34	31	1	32	1		1
36	26	9	35	2		2	50	17	67	46	12	58	4		4
37	28	5	33	4		4	69	15	84	50	19	69	5	1	6
38	45	16	61	2		2	54	24	78	46	21	67	3	2	5
39	19	9	28	4	4	8	31	18	49	38	18	56	3	1	4
40	9	13	22	5		5	14	11	25	10	10	20	3	2	5
41	4	5	9		1	1	11	10	21	10	7	17	1	3	4
42	3	3	6		1	1	4	2	6	3	10	13	1	1	2
43		1	1		1	1		7	7		1	1	1		1
44	1	2	3				1	2	3	1	2	3		2	2
45	1	1	2				1	3	4		3	3			
46	1	1	2					3	3					1	1
47								1	1		1	1			
48								2	2		2	2			
49														1	1
50								1	1						
51															
52															
53															
54															
55															
56															
57															
58															
59															
Total	172	70	242	22	7	29	282	130	412	262	119	381	22	14	36

Table 13 (cont'd)

Fork length (cm)	Set no. 6 M	6 F	6 T	7 M	7 F	7 T	8 M	8 F	8 T	9 M	9 F	9 T	10 M	10 F	10 T
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32				1	2	3									
33	8	2	10	1		1				1	1	2			
34	8	4	12	3	1	4				2		2	1		1
35	16	9	25	3	1	4				5	2	7	1		1
36	41	6	47	5	2	7	2		2	6	1	7	4		4
37	34	15	49	12	5	17				5		5	5		5
38	43	13	56	11	2	13	3		3	8	2	10	2	3	5
39	15	9	24	11	2	13	1		1	6	4	10		1	1
40	14	14	28	7	2	9	2	1	3	1	1	2	4	2	6
41	4	11	15	1	6	7	3	1	4	1	5	6			
42	5	6	11	3		3	3		3	1	2	3		1	1
43		4	4	1		1		2	2	2		2			
44		3	3	1		1							1		1
45															
46	1	1	2	2		2					1	1			
47															
48		1	1		1	1		1	1						
49								1	1				1		1
50														1	1
51															
52															
53															
54															
55															
56															
57															
58															
59															
Total	189	98	287	62	24	86	14	6	20	38	19	57	19	8	27

Table 13 (cont'd)

Fork length (cm)	Set no. 11 M	11 F	11 T	12 M	12 F	12 T	13 M	13 F	13 T	14 M	14 F	14 T	20 T
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30										6	2	8	2
31								1	1	2	1	3	4
32							1		1	7	6	13	7
33								3	3	9	13	22	5
34	1		1							25	17	42	4
35	1		1				1	1	2	23	15	38	12
36	1	1	2				2	1	3	10	6	16	12
37	4		4		1	1	1		1	21	21	42	23
38	3	2	5					2	2	22	17	39	11
39	2	3	5							27	19	46	10
40	3	1	4				1	1	2	19	25	44	5
41								2	2	9	18	27	6
42	1		1					1	1	4	19	23	8
43										2	14	16	1
44										2	6	8	
45		1	1							2	2	4	
46		1	1							1	1	2	
47											1	1	
48													
49											2	2	
50											2	2	
51													
52											3	3	
53								1	1		1	1	
54													
55											1	1	
56													
57													
58											1	1	
59													
Total	16	9	25	0	1	1	6	13	19	191	213	404	110

Table 13 (cont'd)

Fork length (cm)	Set no. 21			23			25			27			28		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
18								2	2						
19															
20							1		1						
21							1		1						
22	1		1				5	3	8						
23							7	5	12						
24		1	1				7	5	12						
25	1		1				4	2	6						
26							1	2	3						
27							1	1	2						
28								1	1						
29	2		2		1	1									
30	1		1										1		1
31		2	2	2		2									
32	1		1	5		5	1		1	2	1	3	6	1	7
33		1	1	5	1	6	1		1	15	2	17	7	3	10
34				5	2	7	1		1	11	12	23	16	9	25
35				5	7	12				9	8	17	12	15	27
36				5		5				17	10	27	12	12	24
37				7	3	10				15	14	29	13	8	21
38				5	2	7				12	11	23	6	7	13
39				7	5	12				13	10	23	8	12	20
40				1	7	8				16	27	43	1	19	20
41		1	1	2	1	3				13	13	26	7	8	15
42				1	4	5				2	19	21	5	17	22
43				1	1	2				4	8	12	1	4	5
44										2	10	12	1	8	9
45											3	3	3	2	5
46										1		1	1	2	3
47				1	1	2				1	1	2		2	2
48										1	1	2		1	1
49											1	1	1		1
50														1	1
51															
52											1	1			
53															
54											1	1			
55															
56															
57														1	1
58															
59															
Total	6	5	11	52	35	87	30	21	51	134	153	287	101	132	233

Table 13 (cont'd)

Fork length (cm)	Set no.														
	31			32			33			34			35		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31													1		1
32										1		1			
33										2		2			
34	3	4	7				3		3	3		3	3		3
35	2	3	5				2		2	6	1	7	3	1	4
36	11		11				1		1	7		7	5		5
37	16	3	19	1		1	5	1	6	7	2	9	2	1	3
38	18	5	23				2		2	9	4	13	5	3	8
39	9	4	13				2	3	5	6	1	7	4	3	7
40	7	8	15		2	2	1	2	3	4	2	6	4	1	5
41	4	5	9				1		1	3	1	4	2		2
42		3	3				1	1	2	3		3			
43											1	1	2		2
44	1	1	2							1		1			
45															
46		1	1												
47															
48															
49															
50															
51															
52															
53															
54															
55															
56															
57															
58															
59															
Total	71	37	108	1	2	3	18	7	25	52	12	64	31	9	40

Table 13 (cont'd)

Fork length (cm)	Set no. 36			38			39			41			42		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34	1		1				1		1						
35	4	1	5	3		3	2	1	3	2		2			
36	6	2	8		1	1				1		1	3		3
37	9	6	15	5		5	5	1	6	2		2	3	1	4
38	13	6	19	5	1	6	9	1	10	7	3	10	4	1	5
39	8	7	15	6	5	11	5	5	10	8	3	11	5	7	12
40	2	6	8	5	7	12	5	6	11	6	6	12	2	3	5
41	2	4	6	3	6	9	3	6	9	7	6	13	4	3	7
42	4	2	6	4	3	7	1	2	3	6	1	7	1	3	4
43		2	2	3	1	4	4	2	6	2	3	5	1	2	3
44	3	2	5	2		2		1	1	1		1			
45				1	2	3		1	1	1		1			
46	1	2	3		1	1		2	2	1		1		1	1
47					1	1		2	2						
48															
49								1	1						
50															
51															
52															
53															
54															
55															
56															
57															
58															
59															
Total	53	40	93	37	28	65	35	31	66	44	22	66	23	21	44

Table 13 (cont'd)

Fork length (cm)	Set no. 43 M	43 F	43 T	Total M	Total F	Total T
18					2	2
19						
20				1		1
21				1		1
22				6	3	9
23				7	5	12
24				7	6	13
25				5	2	7
26				1	2	3
27				1	1	2
28					2	2
29				2	1	3
30				3		3
31				15	6	23
32				22	10	36
33				75	21	103
34				113	54	172
35	1		1	169	80	253
36				279	89	380
37	5		5	323	108	443
38	2	5	7	339	155	517
39		3	3	233	156	400
40	1	10	11	154	182	346
41	5	5	10	111	134	250
42	5	1	6	66	102	174
43	2	3	5	28	63	99
44	2	1	3	20	48	69
45				9	22	31
46		1	1	10	20	30
47				3	10	13
48				1	10	11
49				2	4	6
50					5	5
51					2	2
52					1	1
53					3	3
54					3	3
55						
56					1	1
57					1	1
58						
59					1	1
Total	23	29	52	2,006	1,315	3,431

Table 14. Summary of the length frequencies of walleye pollock from sets in the Strait of Georgia, Strait of Juan de Fuca and off the West Coast of Vancouver Island.

Fork length (cm)	Strait of Georgia			Strait of Juan de Fuca			West Coast Vancouver Isl.		
	M	F	T	M	F	T[1]	M	F	T
18								2	2
19									
20							1		1
21							1		1
22				1		1	5	3	8
23							7	5	12
24					1	1	7	5	12
25				1		1	4	2	6
26							1	2	3
27							1	1	2
28		1	1					1	1
29				2	1	3			
30	1		1	1		1			
31	7	2	9	2	2	6	6	2	8
[illegible]	5	6	11	6		10	10	4	14
[illegible]	39	8	47	5	2	14	31	11	42
34	71	15	86	5	2	12	37	37	74
35	118	33	151	5	7	16	46	40	86
36	221	51	272	5		17	53	38	91
37	276	75	351	7	3	22	40	30	70
38	294	114	408	5	2	30	40	39	79
39	183	110	293	7	5	23	43	41	84
40	109	110	219	1	7	18	44	65	109
41	69	85	154	2	2	9	40	47	87
42	49	42	91	1	4	11	16	56	72
43	18	30	48	1	1	10	9	32	41
44	15	16	31			1	5	32	37
45	4	11	15				5	11	16
46	6	16	22				4	4	8
47		5	5	1	1	2	2	4	6
48		7	7				1	3	4
49	1	3	4				1	1	2
50		2	2					3	3
51								2	2
52								1	1
53								3	3
54								3	3
55									
56								1	1
57								1	1
58									
59								1	1
Total	1,486	742	2,228	58	40	208	460	531	991

[1]Total includes unsexed fish from set 20.

Table 15. Summary of dogfish sampled, July 13-29, 1976.

Set no.	Length				Maturity	Stomach contents	Spines	Remarks[a]
	Male	Female	Total	≤60 cm				
1	4	1	5	0				Total catch
2	26	23	49	48				" "
3	3	9	12	1				" "
4	2	6	8	0				" "
5	30	34	64	57	64		64	" "
6	3	5	8	3				" "
7	2	1	3	1				" "
9	9	3	12	5				" "
10	45	29	74	72	12	61	74	" "
11	10	5	15	15		15	15	" "
12	7	11	18	3				" "
20	619	608	1,227	960				" "
21	30	62	92	66				" "
23	32	25	57	56				" "
24								Not sampled
25	16	14	30	1				Total catch
26								Not sampled
27								" "
28	11	2	13	1				Total catch
29	320	378	698	698				" "
30	42	35	77	73				" "
31	19	12	31	29	29		29	" "
32	4	4	8	7	7		7	" "
33	43	27	70	68			70	" "
34	16	5	21	18			21	" "
35	16	13	29	0			29	" "
36	3	8	11	10			11	" "
37	151	162	313	11			313	" "
38	11	3	14	12			14	" "
39	49	15	64	60			64	" "
40	261	272	533	519			200	L/S-total catch, 1st 200 fish for spines
41	9	7	16	14			16	Total catch
42	3	2	5	5			5	" "
43	24	10	34	33			34	" "

[a] L = Length
S = Sex

Table 16. Mean lengths of dogfish for each age class from the Strait of Georgia, July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean Length (mm)
1	228	267-475	322
2	176	306-406	343
3	116	313-482	369
4	77	322-479	389
5	52	334-529	412
6	48	370-512	432
7	48	247-518	440
8	34	420-538	462
9	23	315-550	458
10	22	413-567	485
11	22	434-566	502
12	19	431-603	506
13	11	412-594	507
14	9	465-579	530
15	11	414-920	593
16	3	573-648	617
17	5	516-663	571
18	8	561-677	609
19	2	560-692	626
20	3	579-740	665
21	4	648-78(0)	73(7)
22	4	650-90(0)	75(8)
23	3	730-83(0)	79(0)
24	1		78(0)
25	1		67(0)
26	2	638-83(0)	73(4)
27			
28			
29	3	71(0)-923	81(7)
30	1		83(0)
31	2	73(0)-83(0)	78(0)
32	1		79(0)
33			
34			
35			
36	3	83(0)-94(0)	89(6)
37	1		72(0)
38	1		88(0)
Total	944		

Table 17. Mean lengths of male dogfish for each age class from the Strait of Georgia, July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean length (mm)
1	118	260-475	322
2	85	294-406	347
3	68	313-484	372
4	43	346-479	396
5	30	334-529	416
6	32	352-486	430
7	29	394-518	438
8	19	426-538	462
9	13	315-550	456
10	10	413-567	508
11	14	425-566	503
12	14	426-567	500
13	7	463-594	516
14	7	465-579	518
15	7	414-920	594
16	1		630
17	4	524-663	585
18	5	561-677	613
19			
20	1		678
21	3	648-77(0)	72(3)
22	1		79(0)
23	2	81(0)-900	85(0)
24	1		78(0)
Total	514		

Table 18. Mean lengths of female dogfish for each age class from the Strait of Georgia, July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean length (mm)
1	111	268-386	322
2	91	297-396	341
3	47	261-482	367
4	34	322-423	380
5	18	369-450	408
6	22	389-512	434
7	19	247-511	445
8	16	420-520	461
9	10	403-502	460
10	13	439-539	472
11	8	434-561	500
12	5	420-603	523
13	2	412-502	457
14	2	567-577	572
15	4	568-626	592
16	2	573-648	610
17	1		516
18	3	575-635	603
19	2	560-692	626
20	2	579-74(0)	66(0)
21	1		78(0)
22	2	65(0)-694	67(2)
23	2	73(0)-83(0)	78(0)
24			
25	1		67(0)
Total	418		

Table 19. Mean lengths of dogfish for each age class for sets above 150 m from the Strait of Georgia, July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean length (mm)
1	182	260-397	322
2	146	294-396	346
3	86	261-484	362
4	45	346-420	386
5	22	363-450	412
6	19	401-478	430
7	14	247-483	423
8	10	426-472	444
9	2	441-484	462
10	5	439-557	472
11	1		496
12	1		420
13			
14			
15	2	579-92(0)	75(0)
16			
17			
18			
19			
20	1		74(0)
21	2	750-77(0)	76(0)
Total	538		

Table 20. Mean lengths of dogfish for each age class for sets *below* 150 m from the Strait of Georgia, July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean length (mm)
1	15	282-367	312
2	9	314-379	348
3	24	335-482	388
4	21	360-479	401
5	21	334-529	408
6	24	352-512	436
7	20	397-518	457
8	13	420-538	463
9	12	412-499	454
10	4	413-565	482
11	14	425-566	497
12	11	426-553	490
13	3	412-594	493
14	4	503-577	542
15	6	468-83(0)	57(6)
16	1		630
17	2	516-524	520
18	5	561-677	613
19			
20	1		579
Total	210		

Table 21. Mean lengths of dogfish for each age class for sets above 150 m from the Strait of Georgia, June 1976 and July 1976. Bracketed figures are not significant.

Age class	Frequency	Range (mm)	Mean length (mm)
1	446	259-475	317
2	260	287-406	344
3	188	313-482	369
4	154	322-542	394
5	119	334-529	417
6	113	362-512	431
7	103	247-518	436
8	84	415-538	461
9	63	315-550	468
10	60	413-567	489
11	42	390-566	493
12	45	419-603	504
13	34	348-595	506
14	22	465-640	536
15	20	414-920	566
16	9	462-68(0)	57(9)
17	11	516-88(0)	62(0)
18	12	561-677	610
19	3	560-692	612
20	9	579-82(0)	67(7)
21	9	551-82(0)	71(5)
22	7	650-90(0)	76(8)
23	8	604-90(0)	75(6)
24	2	65(0)-78(0)	71(5)
25	5	67(0)-88(0)	74(6)
26	6	638-83(0)	73(7)
27	2	82(0)-84(0)	83(0)
Total	1,836		

Table 22. Mortality estimates for dogfish from the Strait of Georgia, June and July 1976, calculated from the slope of the regression $y = a + bx$ where $y = \log_{10}$ frequency, x = age in years.

Age interval	Regression statistics				Mortality	
	a	b	r	Sxy	A (annual)	Z (instantaneous)
1-4 incl.	2.7630	-.1526	.9770	.0526	.30	.35
5-19 incl.	2.7194	-.1008	.9610	.1346	.21	.23
20-27 incl.	2.5334	-.0773	.6989	.2092	.16	.18
1-27[a] incl.	2.5372	-.0909	.9667	.1732	.17	.19

[a]Determined from Robson and Chapman 1961.

Table 23. Summary of species sampled, other than hake, pollock and dogfish, July 13-29, 1976.

Species	Set no.	Type of sample taken: Length	Sex	Stomach contents	Total	Sample preserved	Remarks
Brown cat shark	10	6	6	6	6		Total catch
	32	1	1		1	1	" "
	33	10	10		10	10	" "
	34	20	20		20	20	" "
	35				1	1	" "
	39	8	8		8		" "
California headlightfish	39				1	1	Total catch
Eulachon	25	138					Random sample of total catch
Pacific herring	25	215					Random sample of total catch
Chinook salmon	1	1	1		1		Total catch
	3	1	1		1		" "
	4	3	3		3		" "
	20	4			4		" "
	21	1	1		1		" "
	24				1		" "
	26	1	1		1		" "
	33	1	1		1		" "
	37	2			2		" "
Chum salmon	37	1			1		Total catch
Coho salmon	1	1	1		1		Total catch
	5				1	1	" "

Table 23 (cont'd)

Species	Set no.	Type of sample taken: Length	Sex	Stomach contents	Total	Sample preserved	Remarks
	20	4			4		" "
	22	7			7		" "
	24				4		" "
	29	7			7		" "
	37	23			23		" "
Pink salmon	20	1			1		Total catch
Sockeye salmon	1	1	1		1		Total catch
	37	1			1		" "
Pacific lamprey	4	1			1	1	Total catch
	27	1			1	1	" "
	31	2			2	2	" "
	35				1	1	" "
River lamprey	29	1	1		1	1	Total catch
Pallid eelpout	5				2	2	Total catch
	32				2	2	" "
	33				2	2	" "
	34				31	31	" "
	42				29	29	" "
Wattled eelpout	39				1	1	Total catch
Tadpole snailfish	32				4	4	Total catch
Unknown sculpin	11				1	1	Total catch

Table 23 (cont'd)

Species	Set no.	Type of sample taken: Length	Sex	Stomach contents	Total	Sample preserved	Remarks
Blackfin sculpin	5				1	1	Total catch
Lingcod	21	1	1		1		Total catch
	29	1			1		" "
Pacific cod	25	1	1		1		Total catch
Sablefish	5	3	3	3	3		Total catch
	10	2			2		" "
Jack mackerel	19	16			16		Total catch
Widow rockfish	12	1			1		Total catch
	19	339					Random sample of total catch
Yellowtail rockfish	1	1			1		Total catch
	3	3			3		" "
	8	1			1		" "
	12	7			7		" "
	13	3	3		3		" "
	19	7			7		Random sample of total catch

Table 24. Length frequency of brown cat shark.

Fork length (cm)	Set no. 10 M	10 F	10 T	32 M	32 F	32 T	33 M	33 F	33 T	34 M	34 F	34 T
22												
23												
24												
25												
26												
27												
28											1	1
29												
30												
31												
32											1	1
33												
34												
35												
36							1		1			
37												
38							1		1			
39												
40											3	3
41												
42		1	1							1		1
43											1	1
44												
45							1		1		2	2
46		1	1				1		1			
47										1		1
48												
49							1		1			
50							1		1	3		3
51	2	1	3		1	1	2		2	2		2
52							1		1	1		1
53							1		1	1		1
54										2		2
55	1		1									
56												
57											1	1
58												
59												
Total	3	3	6	0	1	1	10	0	10	11	9	20

Table 24 (cont'd)

Fork length (cm)	Set no. 39 M	39 F	39 T	Total M	Total F	Total T
22		1	1		1	1
23		1	1		1	1
24						
25						
26						
27						
28					1	1
29						
30						
31						
32					1	1
33						
34						
35						
36				1		1
37						
38				1		1
39						
40					3	3
41						
42				1	1	2
43		1	1		2	2
44	1		1	1		1
45				1	2	3
46				1	1	1
47				1		1
48						
49				1		1
50		1	1	4	1	5
51				6	2	8
52				2		2
53	1		1	3		3
54	1		1	3		3
55				1		1
56						
57					1	1
58						
59		1	1		1	1
Total	3	5	8	27	18	45

Table 25. Length frequency of salmon.

Length (cm)	Chinook									Chum	
	Set no.									Set no.	
	1	3	4	20	21	26	33	37	Total	37	Total
14										1	1
15											
16											
17								1	1		
18											
19								1	1		
20											
21											
22							1		1		
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38			1						1		
39	1								1		
40			1						1		
41											
42				1					1		
43			1						1		
44											
45				1					1		
46											
47						1			1		
48											
49											
50											
51											
52											
53											
54											
55											
56											
57				1					1		
58											

Table 25 (cont'd)

Length (cm)	Chinook									Chum	
	Set no.									Set no.	
	1	3	4	20	21	26	33	37	Total	37	Total
59											
60				1	1				2		
61											
62		1							1		
Total	1	1	3	4	1	1	1	2	14	1	1

Table 25 (cont'd)

Length (cm)	Coho						Pink		Sockeye		
	Set no.						Set no.		Set no.		
	1	20	22	29	37	Total	20	Total	1	37	Total
14			1			1				1	1
15											
16			1			1					
17											
18				1		1					
19											
20			1		2	3					
21				1	2	3			1		1
22				3	7	10					
23			1	1	5	7					
24				1	4	5					
25					3	3					
26											
27			1			1					
28			2			2					
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40							1	1			
41											
42											
43											
44											
45											
46											
47											
48	1					1					
49											
50											
51											
52		1				1					
53											
54											
55		1									
56		1									
57											
58		1									

Table 25 (cont'd)

Length (cm)	Coho						Pink		Sockeye		
	Set no.						Set no.		Set no.		
	1	20	22	29	37	Total	20	Total	1	37	Total
59											
60											
61											
62											
Total	1	4	7	7	23	42	1	1	1	1	2

Table 26. Length frequency of rockfish.

Length (cm)	Yellowtail rockfish							Widow rockfish		
	Set no.							Set no.		
	1	3	8	12	13	19	Total	12	19	Total
32									1	1
33								1	3	4
34									8	8
35									13	13
36									17	17
37									27	27
38									19	19
39									27	27
40					1		1		22	22
41					1		1		23	23
42					1	1	2		26	26
43									33	33
44		1		2			3		33	33
45				2		1	3		22	22
46		1	1	2		2	6		20	20
47									14	14
48									13	13
49				1		1	2		9	9
50									5	5
51									3	3
52		1					1			
53						1	1		1	1
54						1	1			
55										
56										
57										
58										
59										
60	1						1			
Total	1	3	1	7	3	7	22	1	339	340

Table 27. Length frequency of other species.

Length (cm)	Eulachon Set no. 25	Herring Set no. 25	Jack mackerel Set no. 19
8	8		
9	5		
10	21	1	
11	35	5	
12	37	27	
13	14	45	
14	9	23	
15	4	15	
16	1	8	
17	1	5	
18	1	11	
19	2	18	
20		14	
21		16	
22		17	
23		7	
24		2	
25			
26			
27			
28		1	
53			1
54			
55			2
56			3
57			1
58			3
59			1
60			3
61			1
62			1
Total	138	215	16

Table 28. Length frequency of lamprey.

Length (cm)	Pacific lamprey				River lamprey	
	Set no.				Set no.	
	4	27	31	Total	29	Total
16.3	1			1		
16.4						
16.5						
16.6						
16.7						
16.8						
16.9						
17.0						
17.1						
17.2						
17.3						
17.4						
17.5						
17.6						
17.7						
17.8						
17.9						
18.0		1	2	3		
18.1						
18.2					1	1
Total	1	1	2	4	1	1

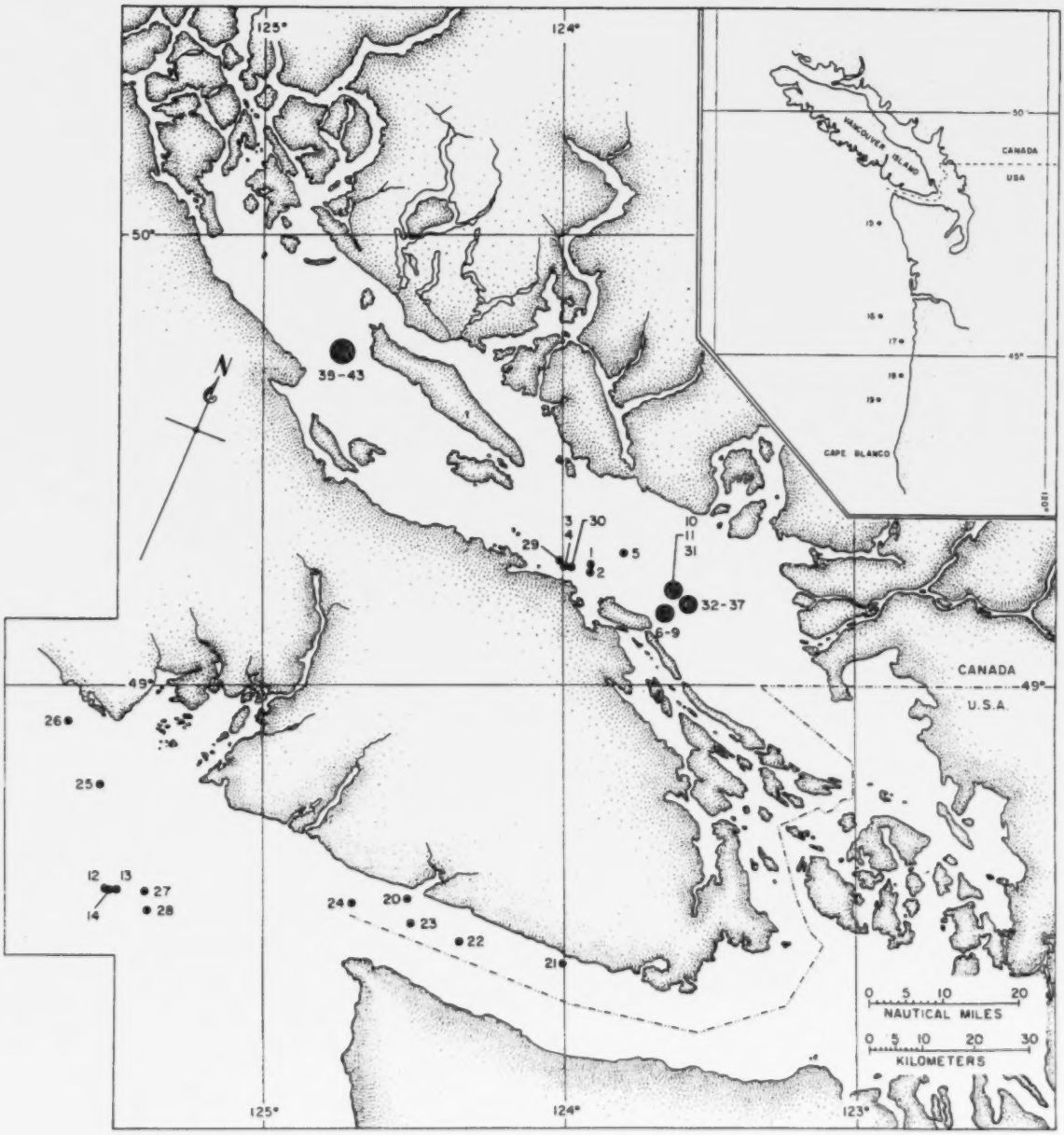

Fig. 1. Set locations, July 1976.

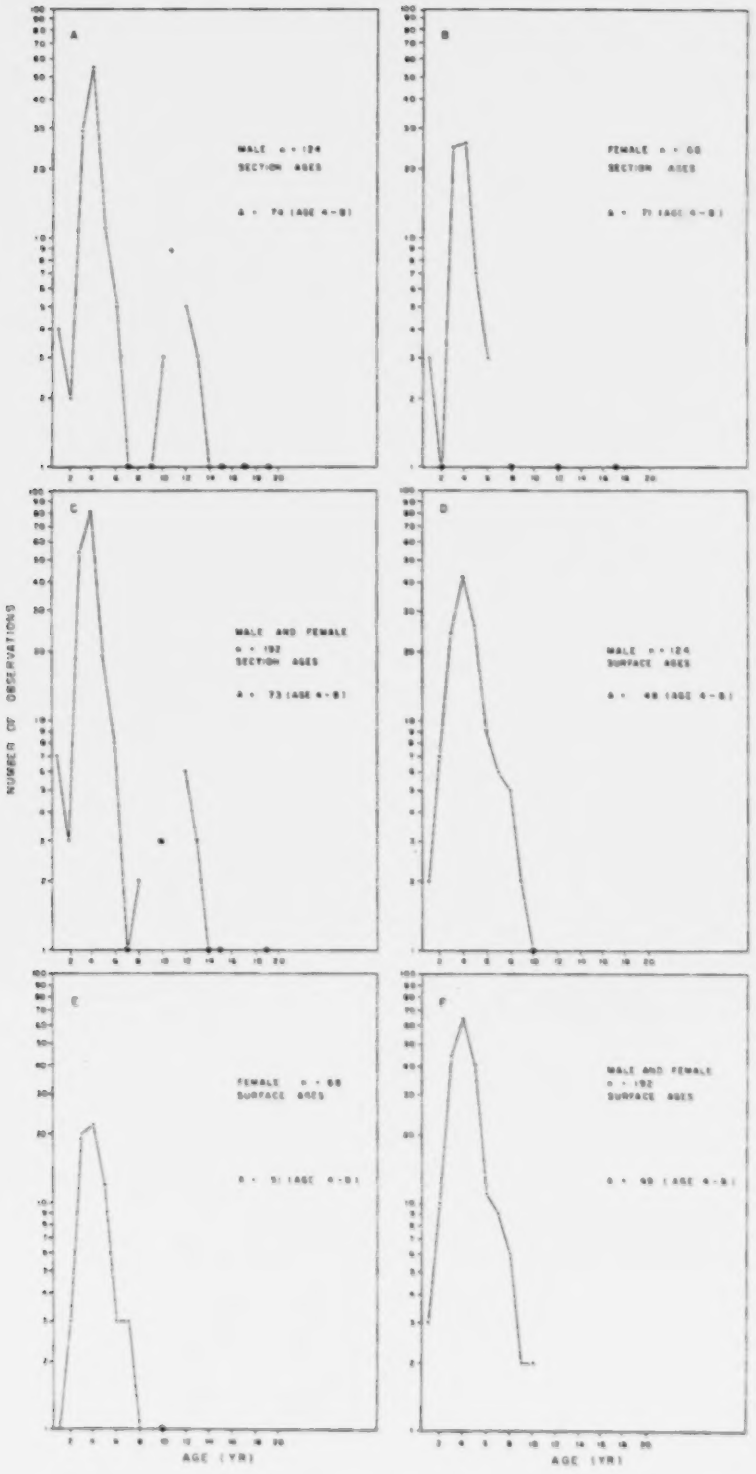

Fig. 2. Pacific hake catch curves for the sample from set 30 for both surface and sections of otoliths.

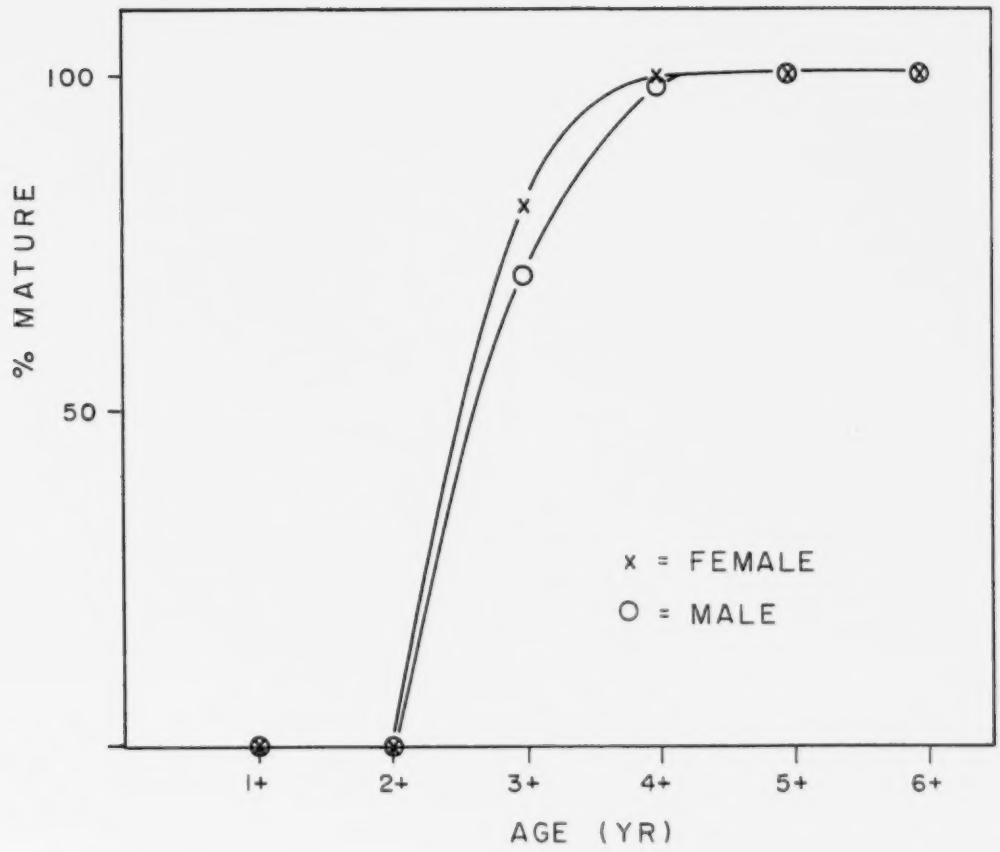

Fig. 3. Age at 50% maturity for Pacific hake sampled from set 30.

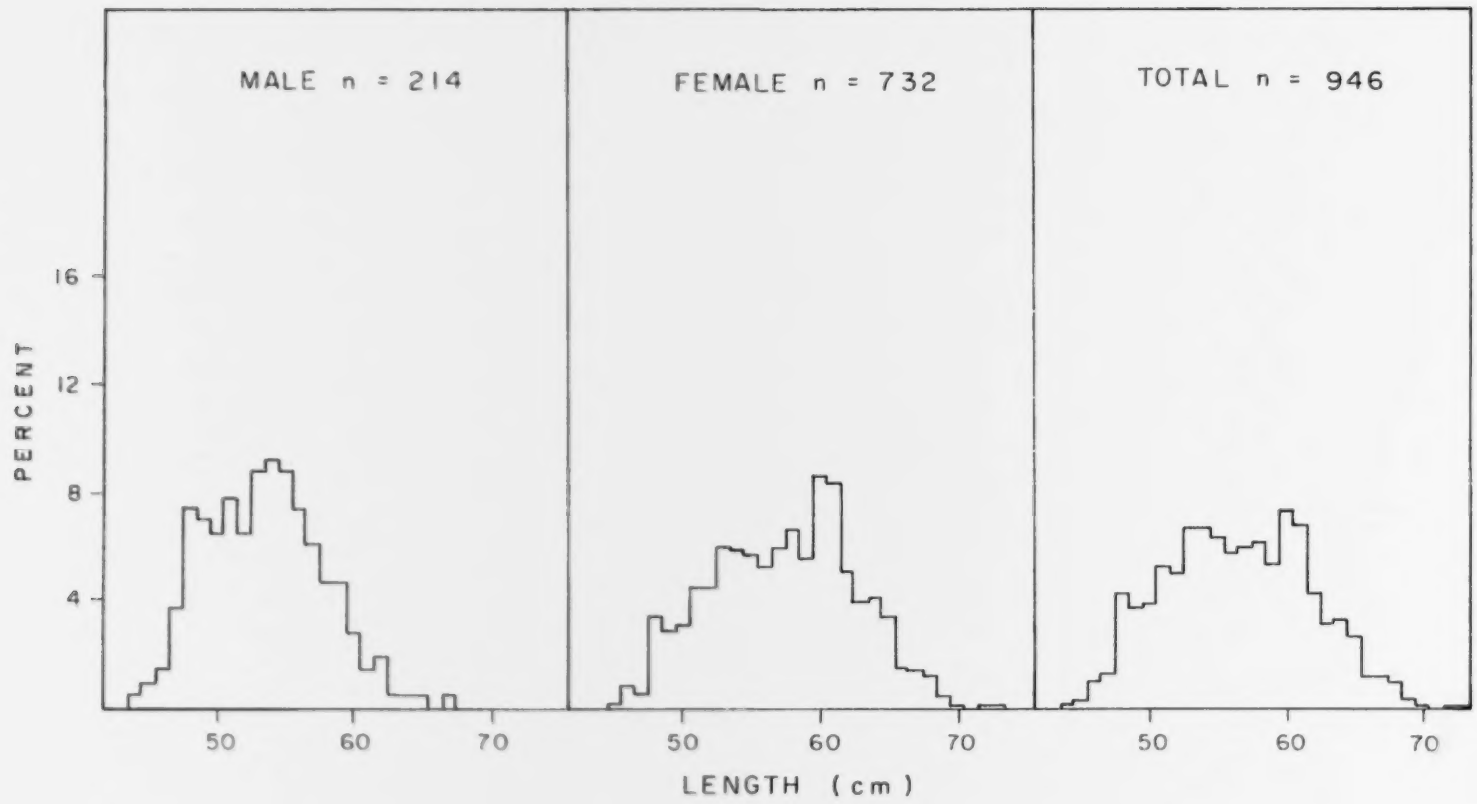

Fig. 4. Length frequency of hake off the west coast of Vancouver Island, July 1976.

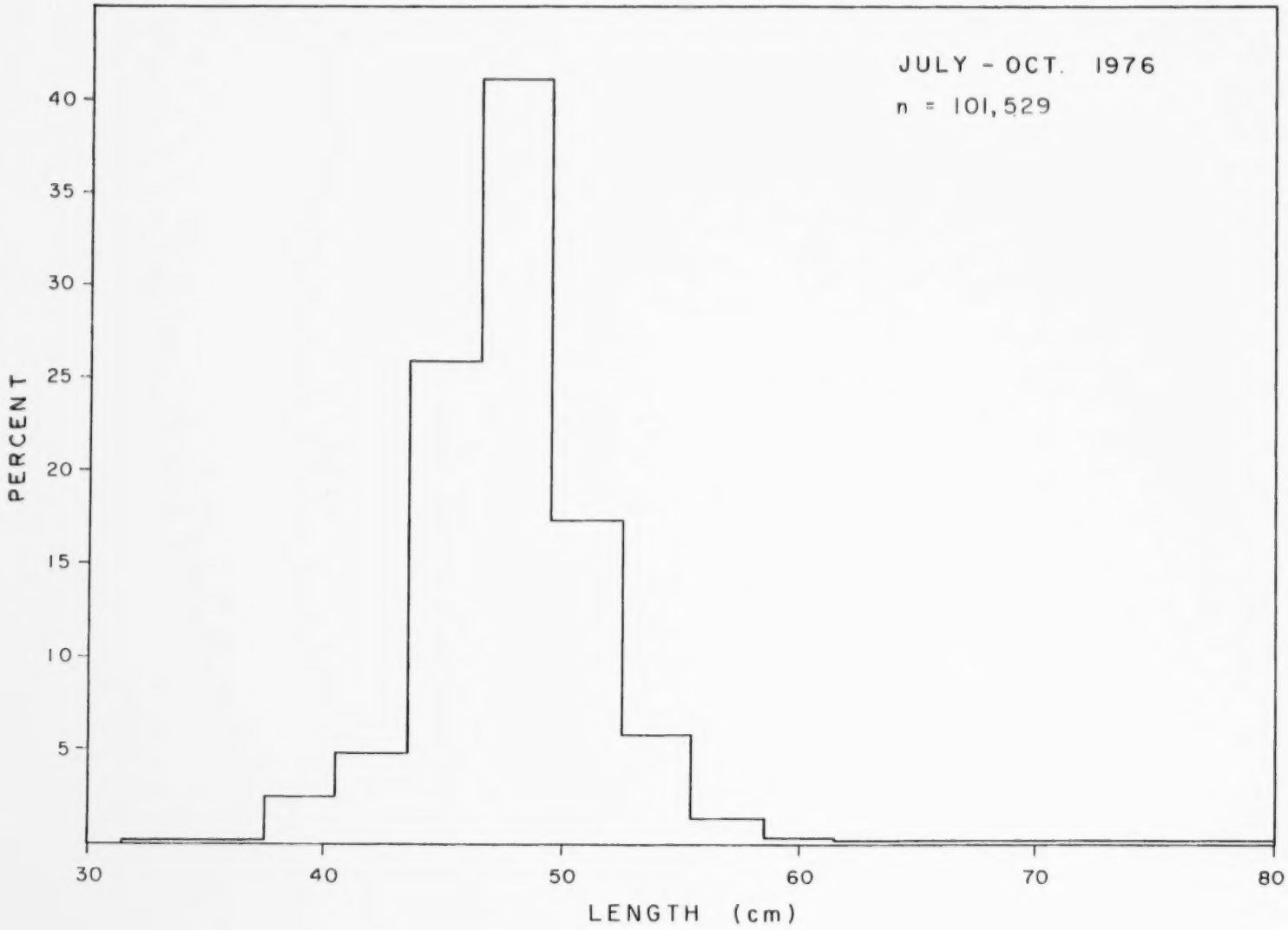

Fig. 5. Length frequency distribution of Pacific hake caught in the Polish and U.S.S.R. fishery off the states of Washington and Oregon, July to October 1976.

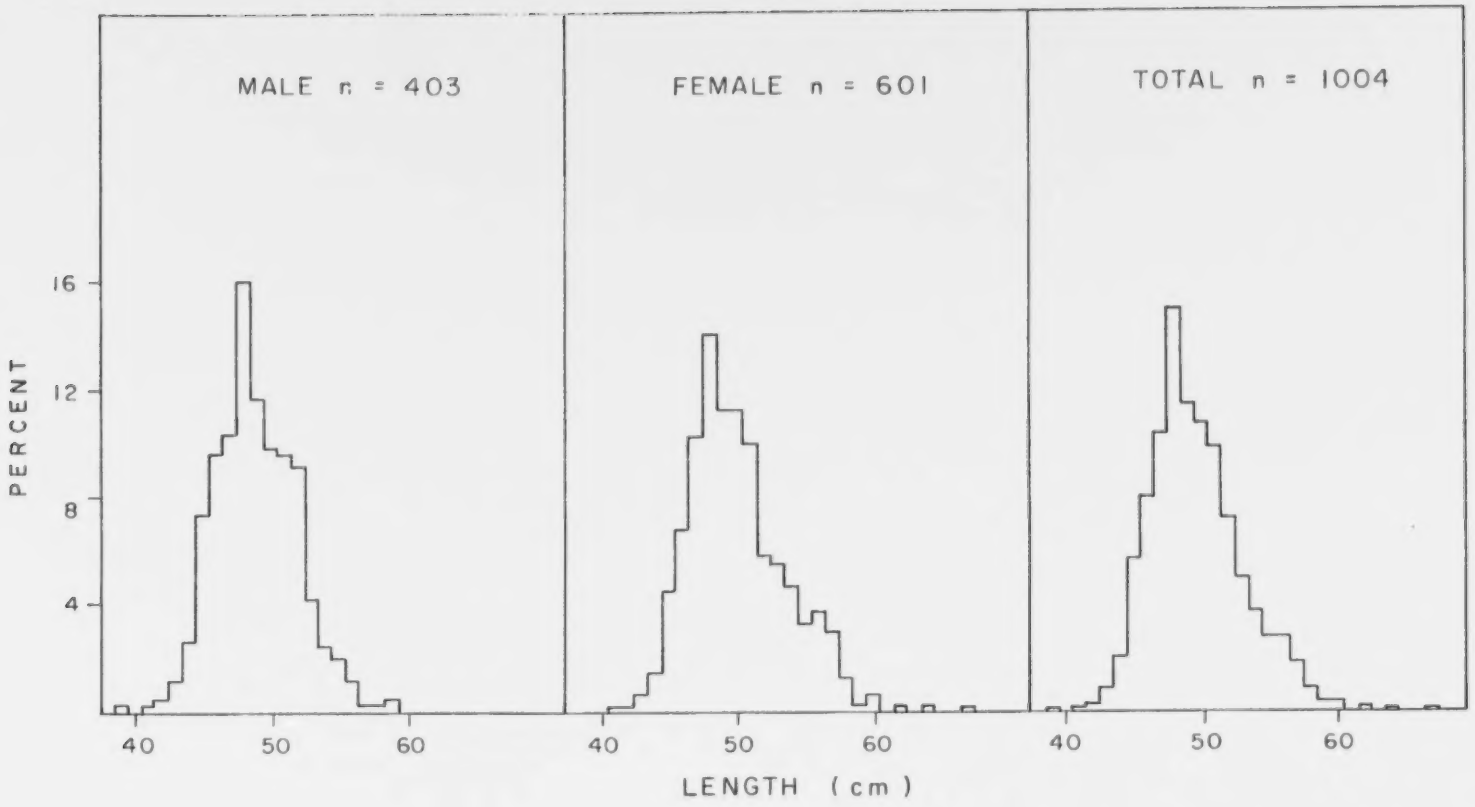

Fig. 6. Length frequency of hake off the coast of Washington and Oregon, July 1976.

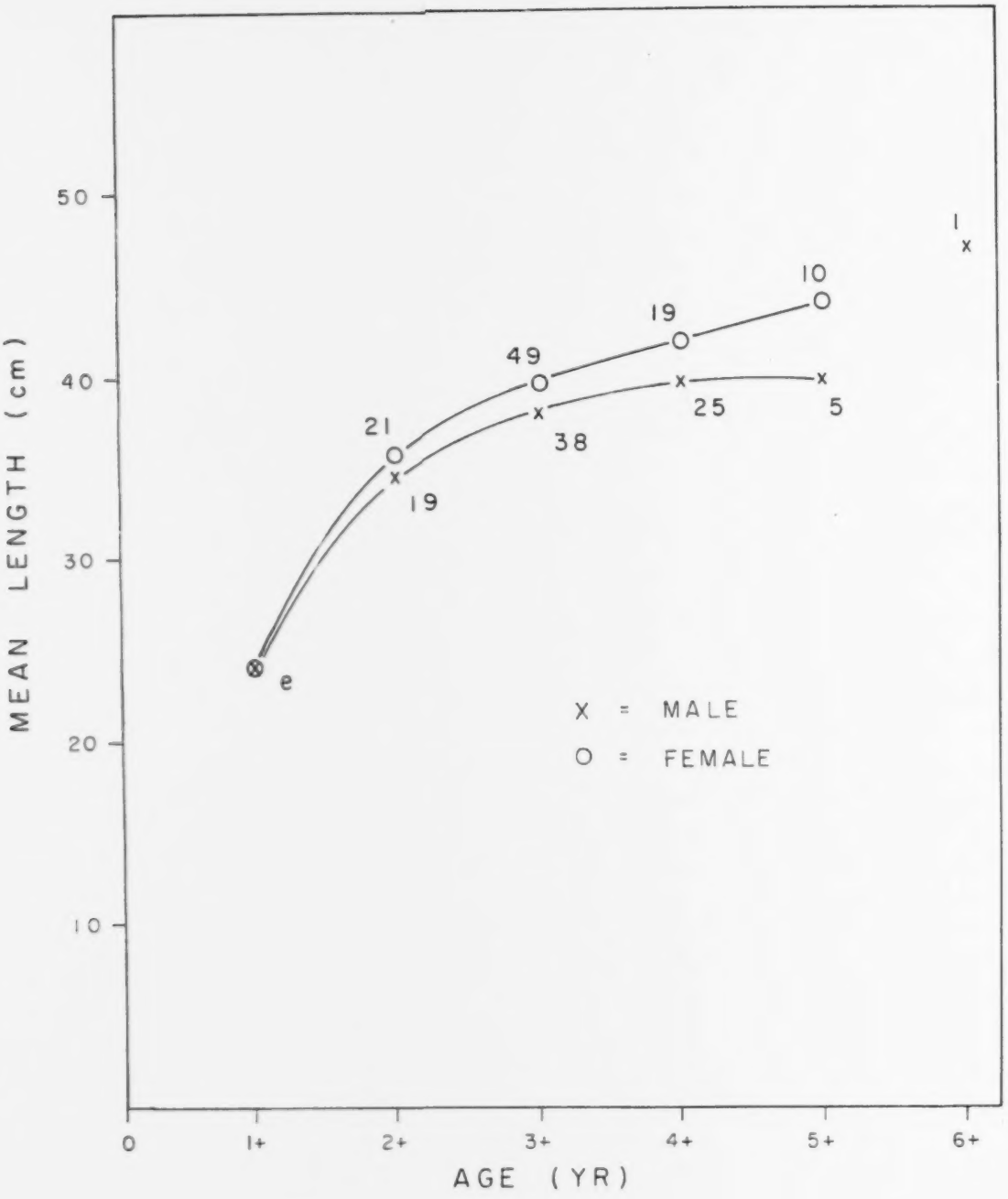

Fig. 7. Growth curve for walleye pollock off the west coast of Vancouver Island. "e" represents the estimated mean size of age 1+ fish determined from the length frequency from Set 25.

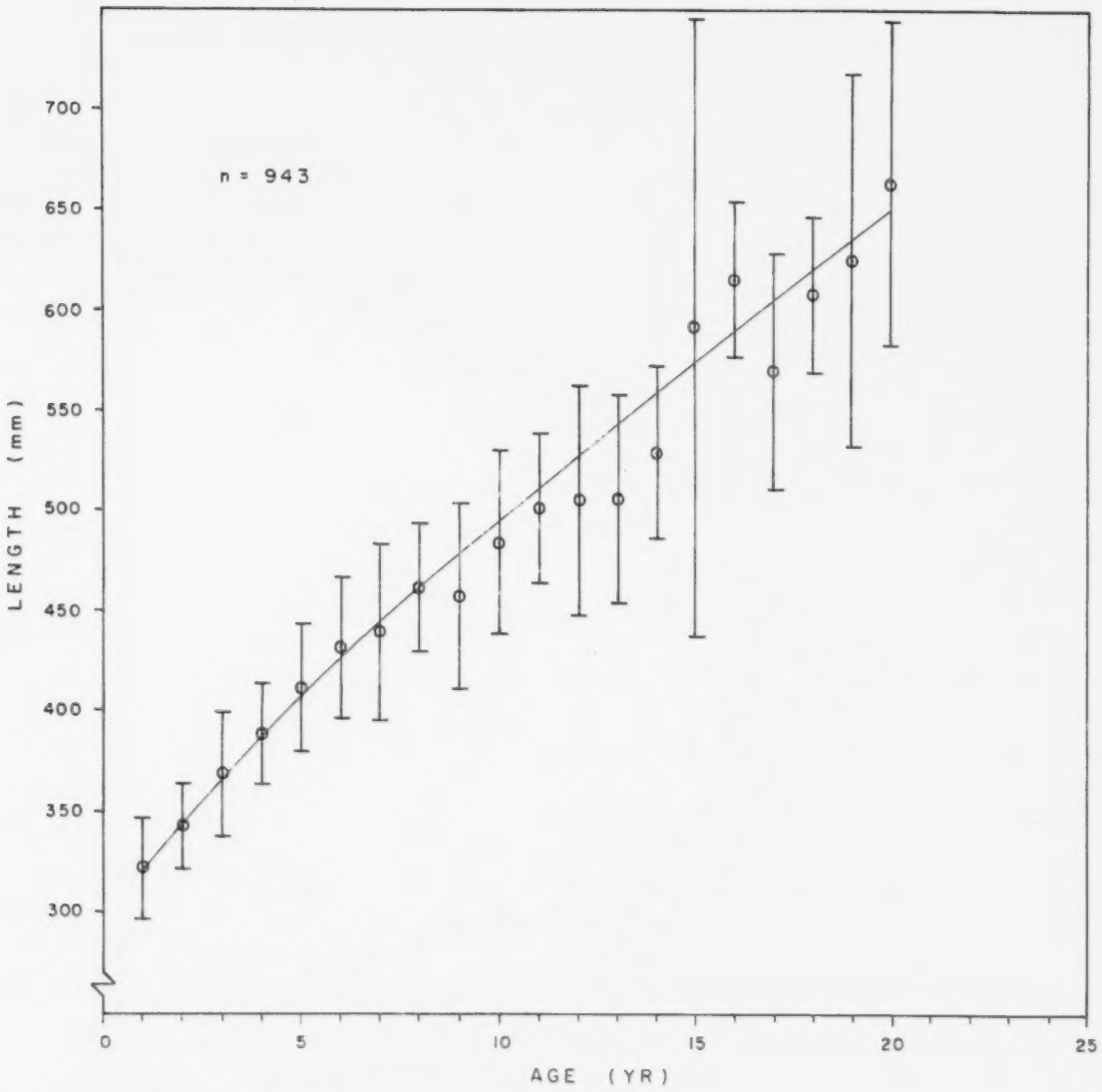

Fig. 8. Growth curve of dogfish for combined catches from the Strait of Georgia, July 1976.

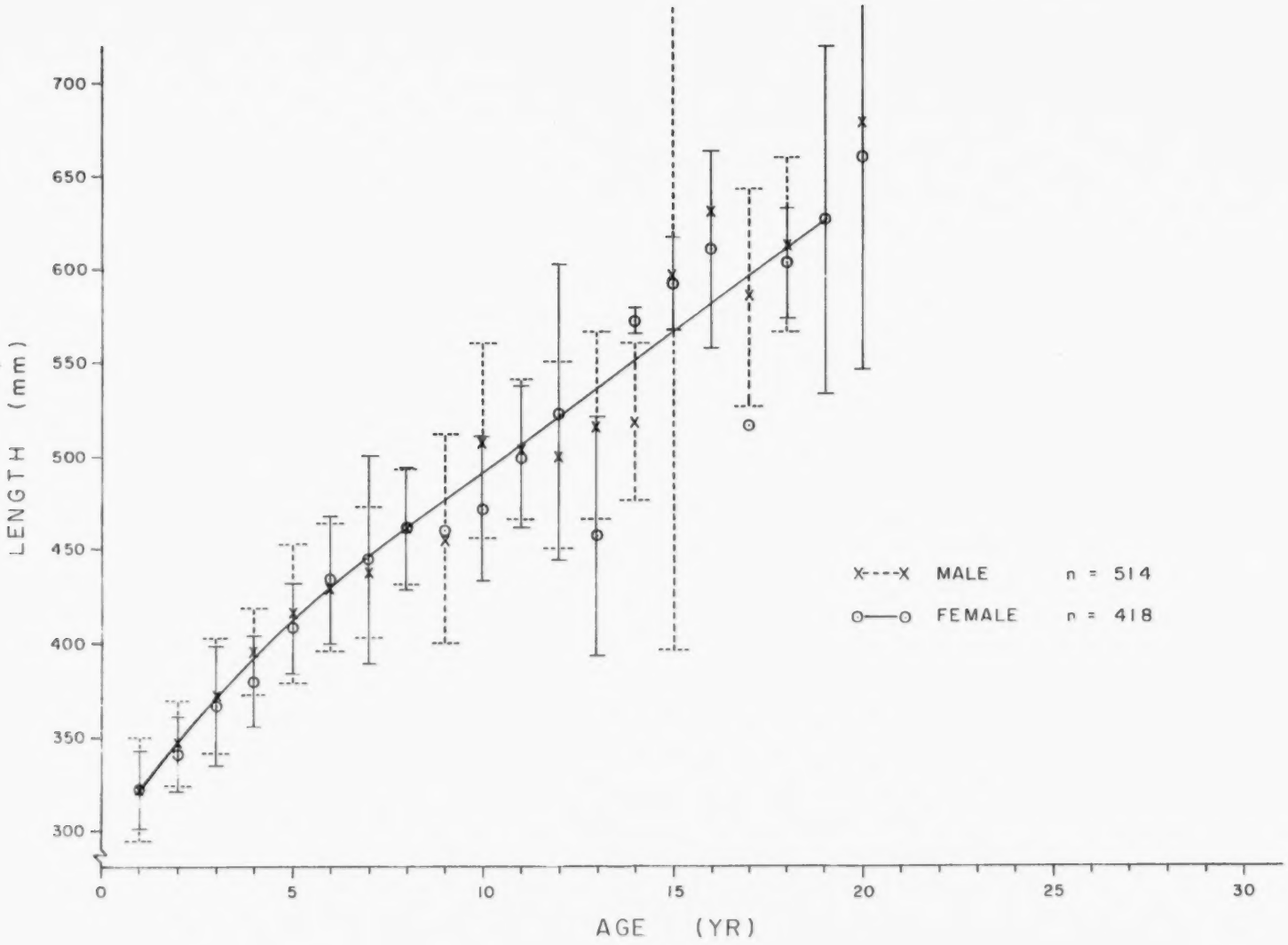

Fig. 9. Growth curves for male and female dogfish from the Strait of Georgia, July 1976.

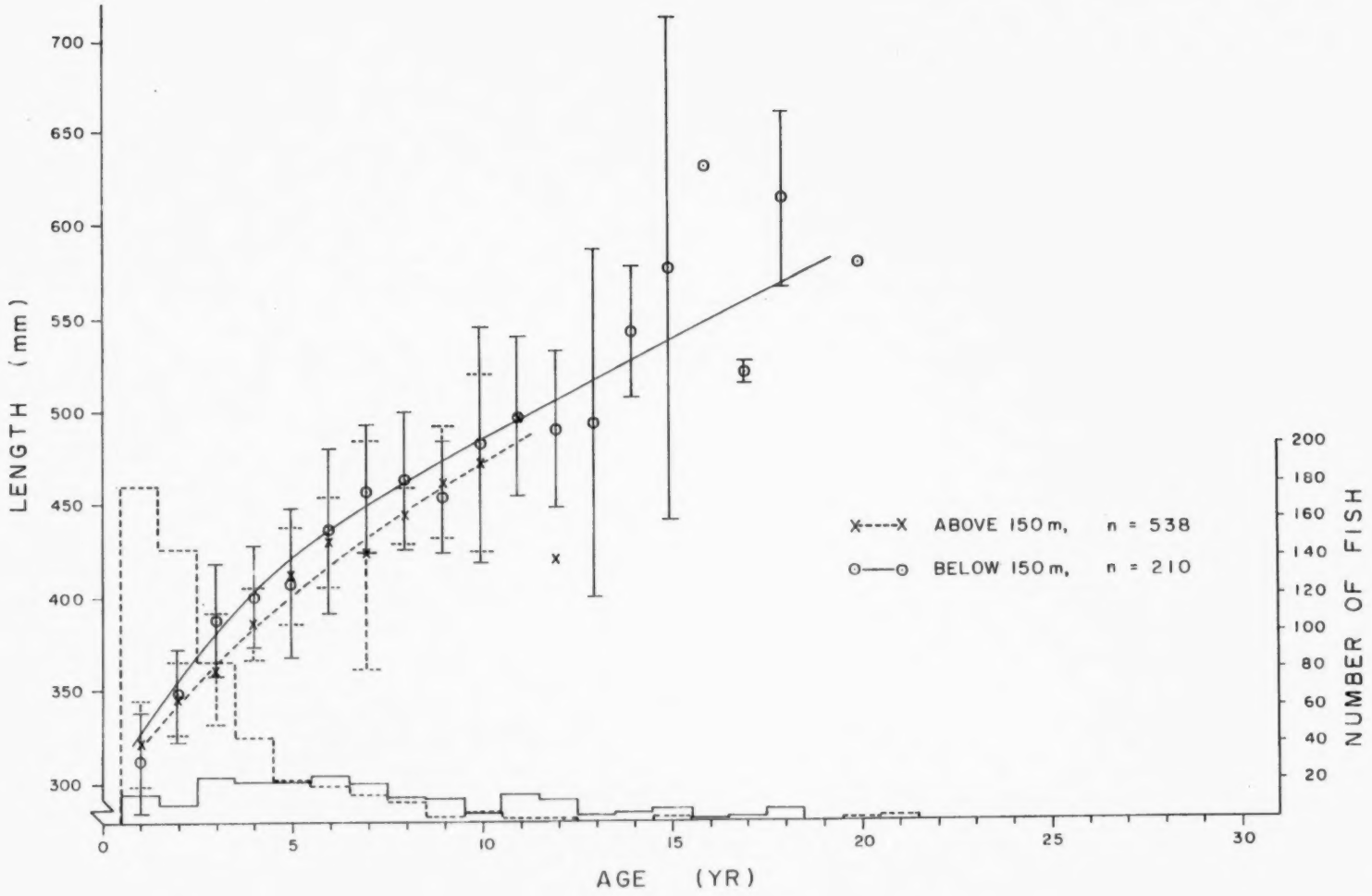

Fig. 10. Growth curves and age frequencies for dogfish above and below 150 m (average depth of plankton layer) from the Strait of Georgia, July 1976.

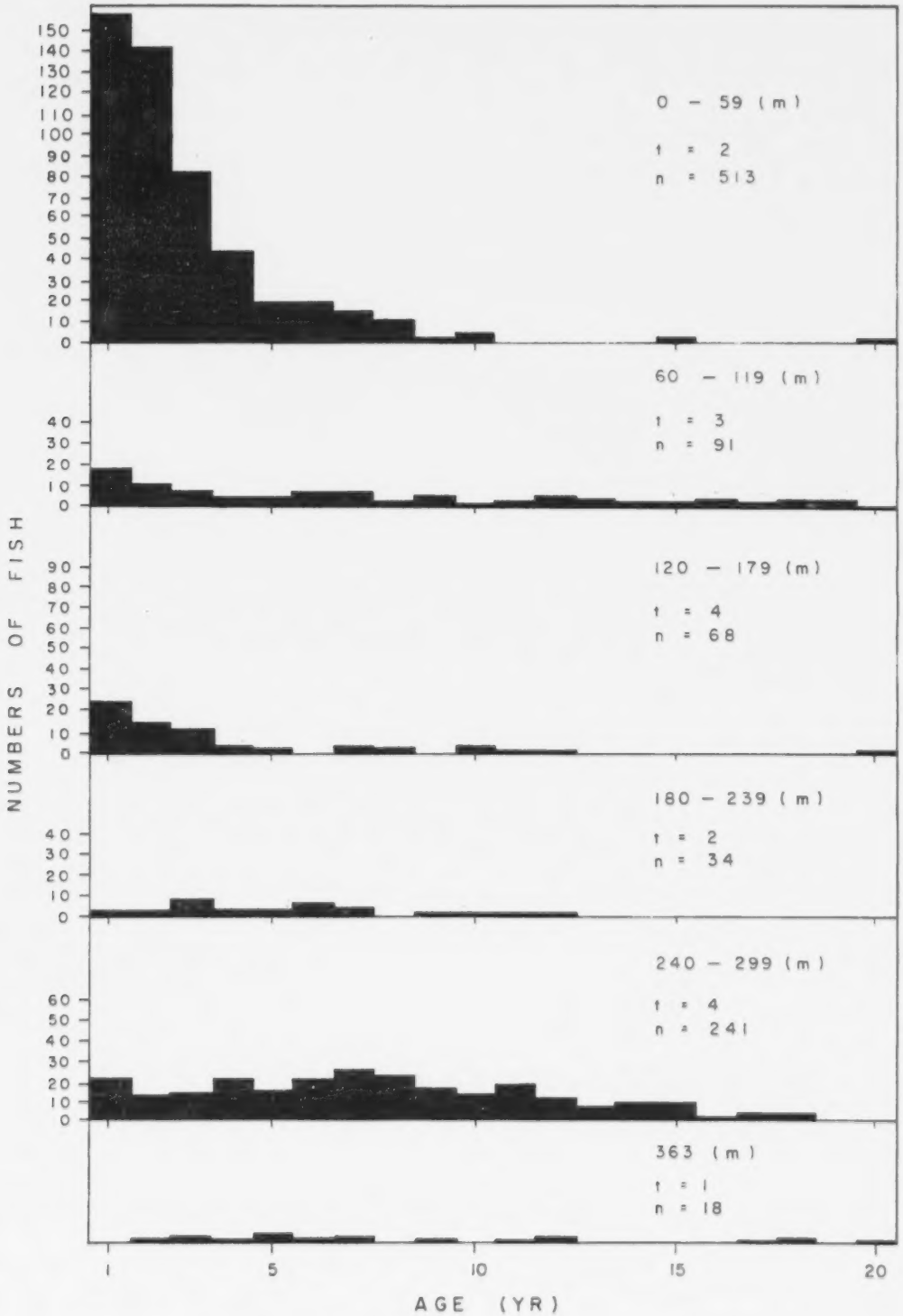

Fig. 11. Length frequencies of dogfish by age class, by depth interval, July 1976. "t" represents number of tows.

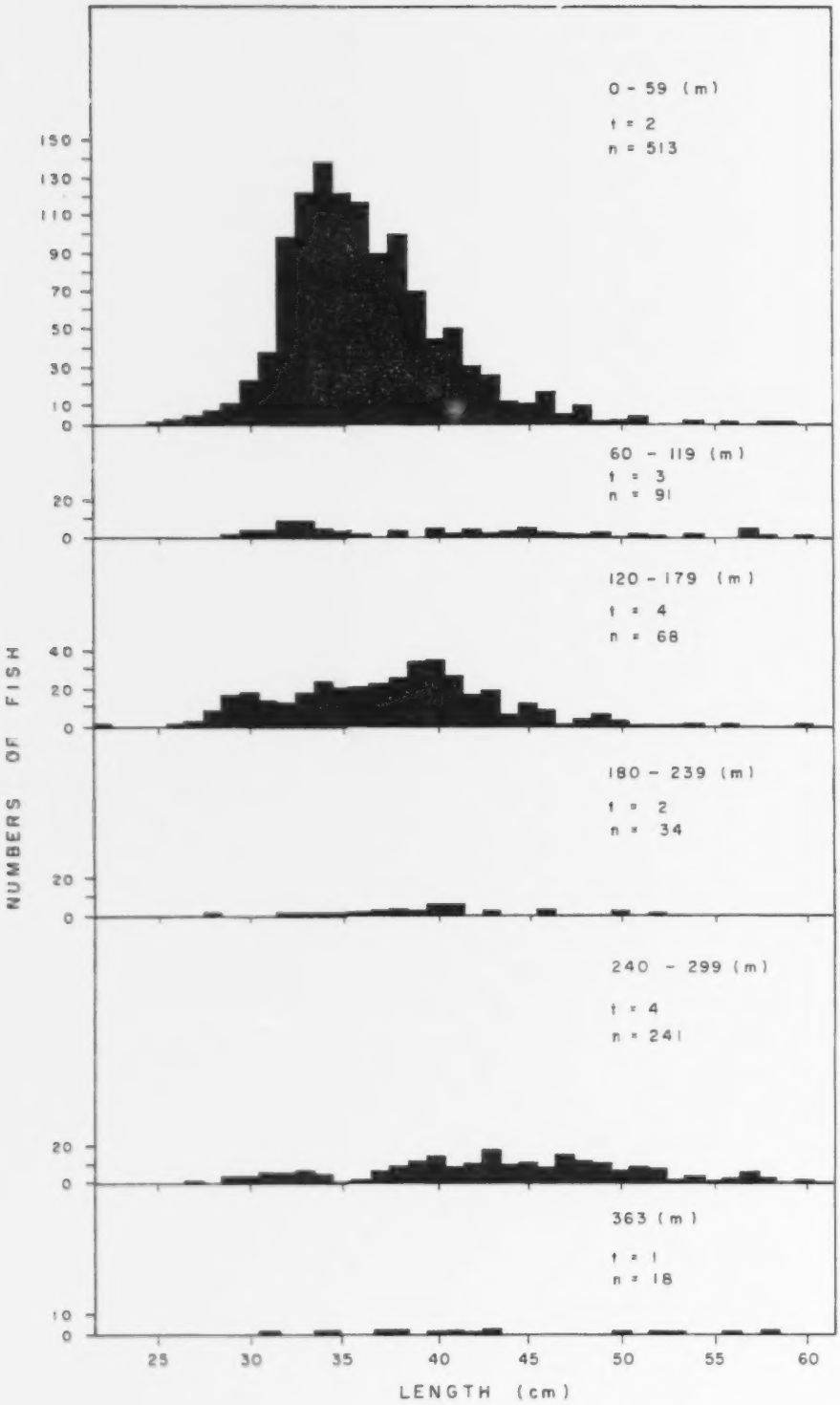

Fig. 12. Length frequencies of dogfish by age class and by depth interval, July 1976. "t" represents numbers of tows.

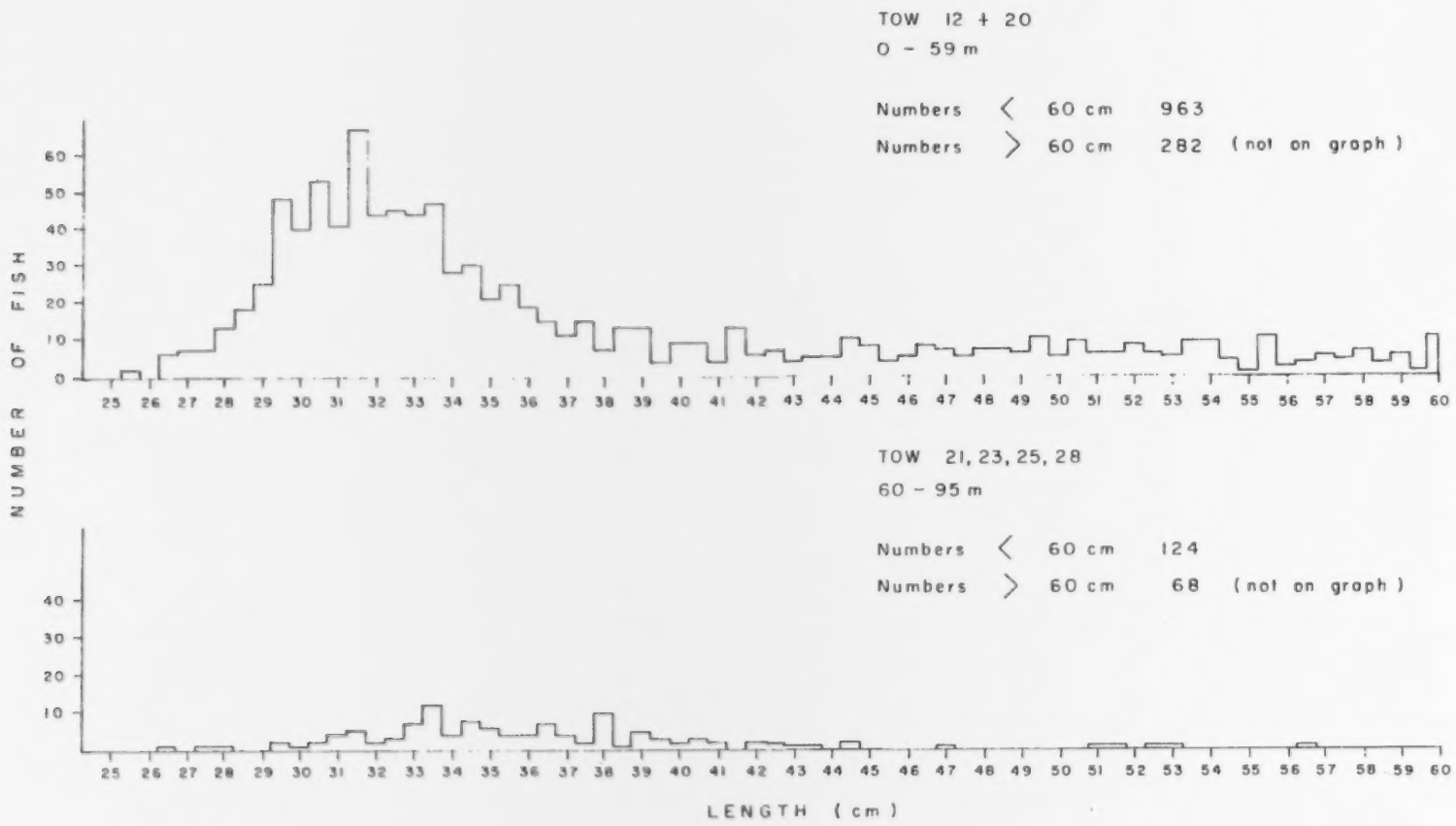

Fig. 13. Length frequencies of dogfish by depth (0-59 m and 60-95 m) for combined samples from the Strait of Juan de Fuca and southwest Vancouver Island, July 1976. Histogram in 5 mm intervals.

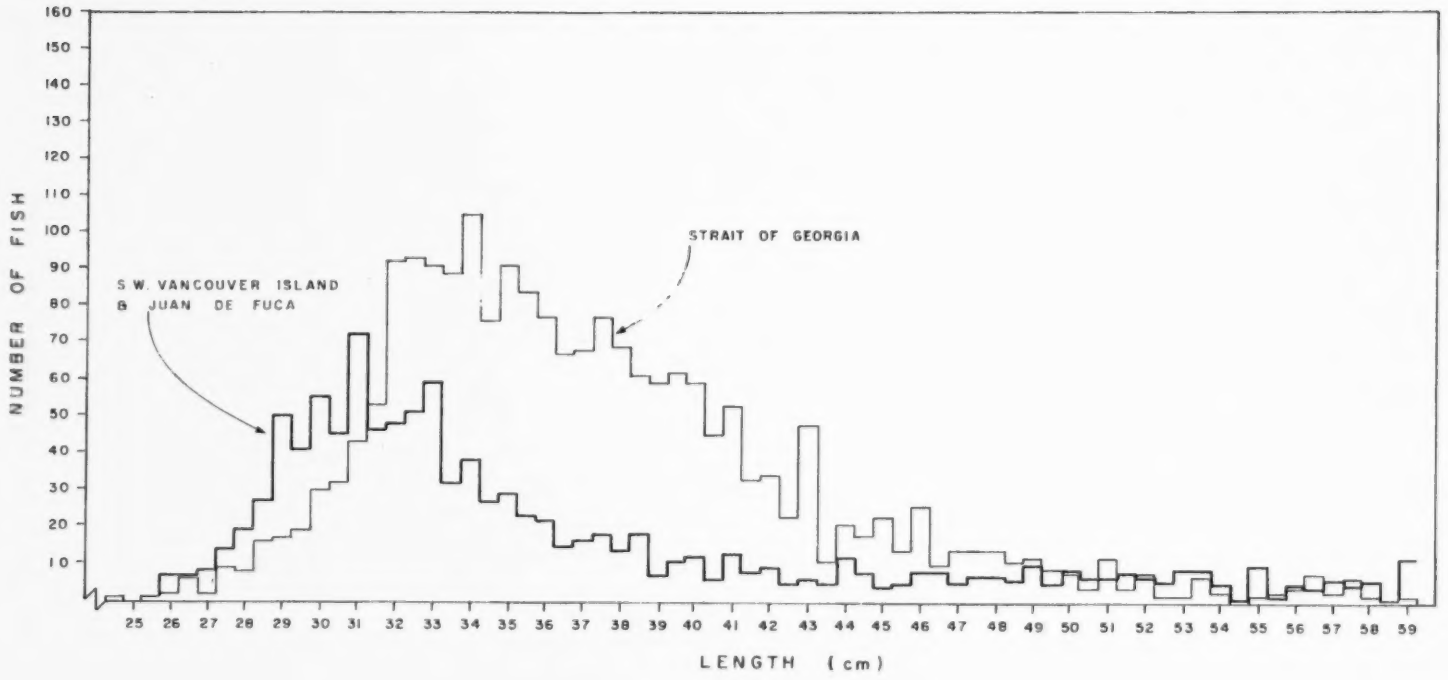

Fig. 14. Length frequencies of dogfish from the Strait of Georgia and combined sets from the Strait of Juan de Fuca and southwest Vancouver Island, July 1976. Historgram is 5 mm intervals.

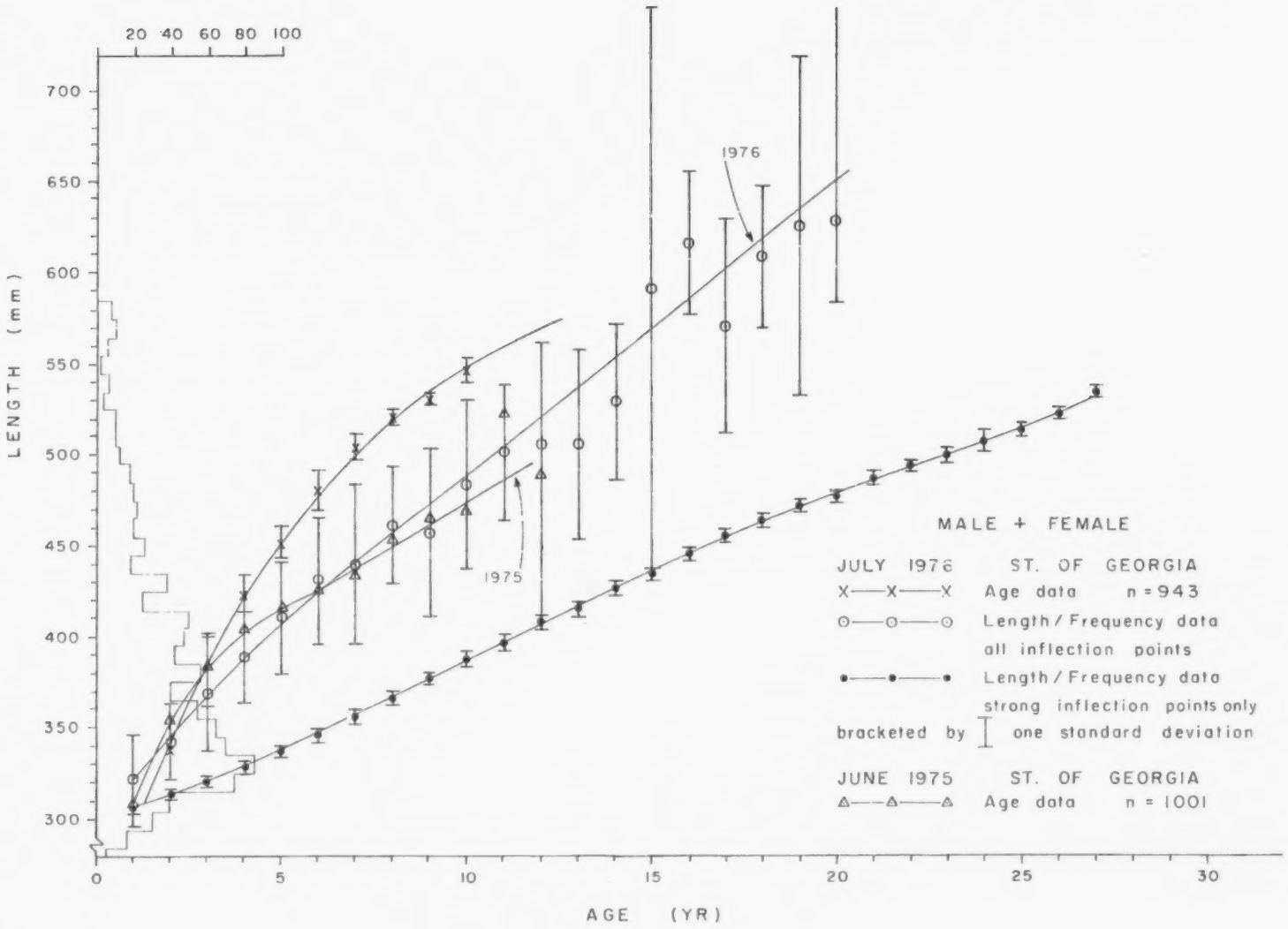

Fig. 15. Comparison of growth curves for dogfish sampled from the Strait of Georgia in June and July 1976 using age data and length-frequency analysis. Length frequency histogram is from July 1976.

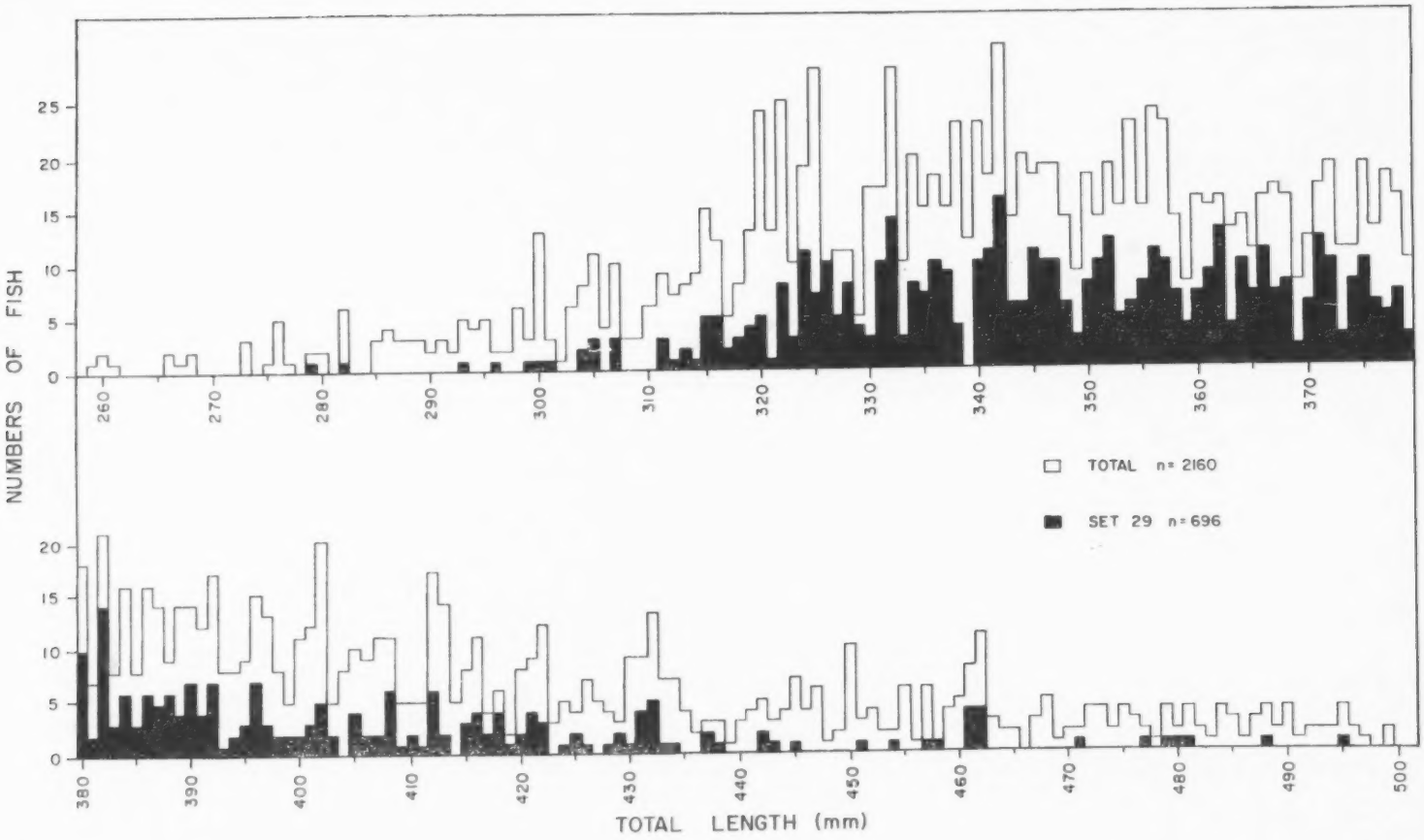

Fig. 16. Length frequency distribution of dogfish (mm) from the Strait of Georgia, July 1976. Shaded historgram is length frequency of dogfish from Set 29 for comparison of modes with total catch.

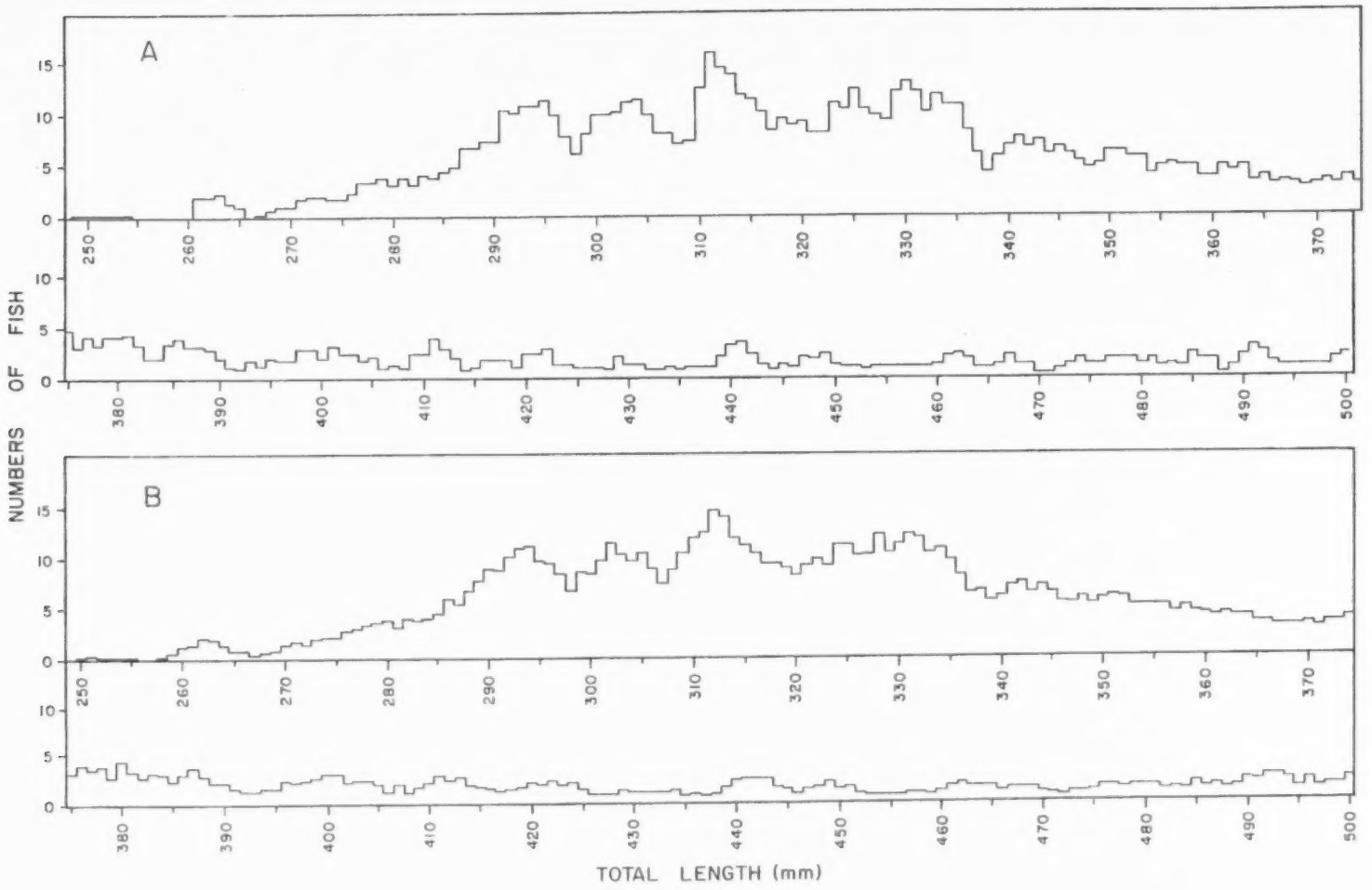

Fig. 17. Length frequency of dogfish caught in the Strait of Juan de Fuca and Southwest Vancouver Island, July 1976. A. Smoothed by running average of "3", Sets 12, 20, 23, 25, 28. B. Smoothed by running average of "5", Sets 12, 20, 21, 23, 25, 28.

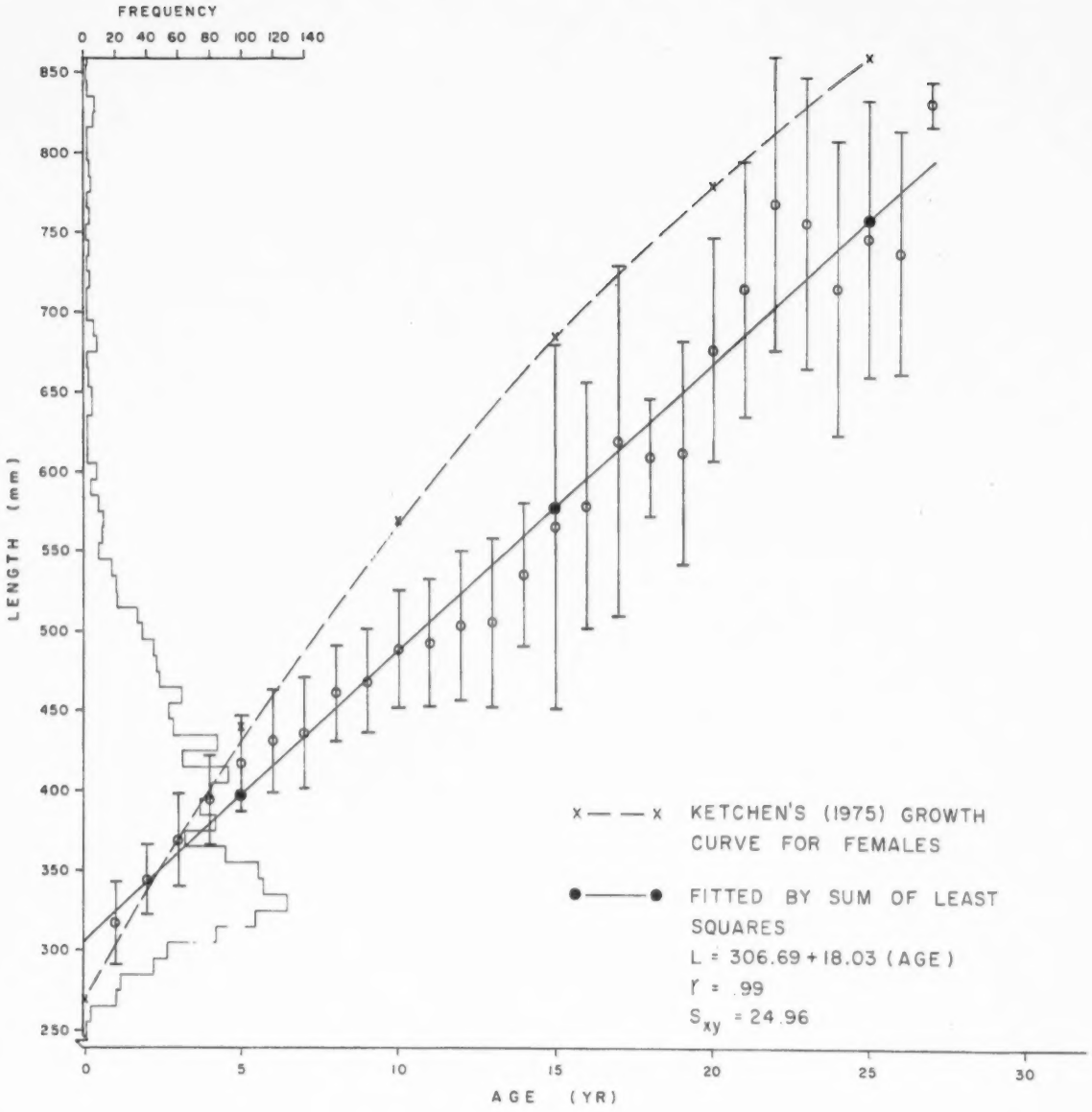

Fig. 18. Comparison of growth curve of female dogfish from the Strait of Georgia, July 1976, by the least squares method to the growth curve estimated by Ketchen (1975).

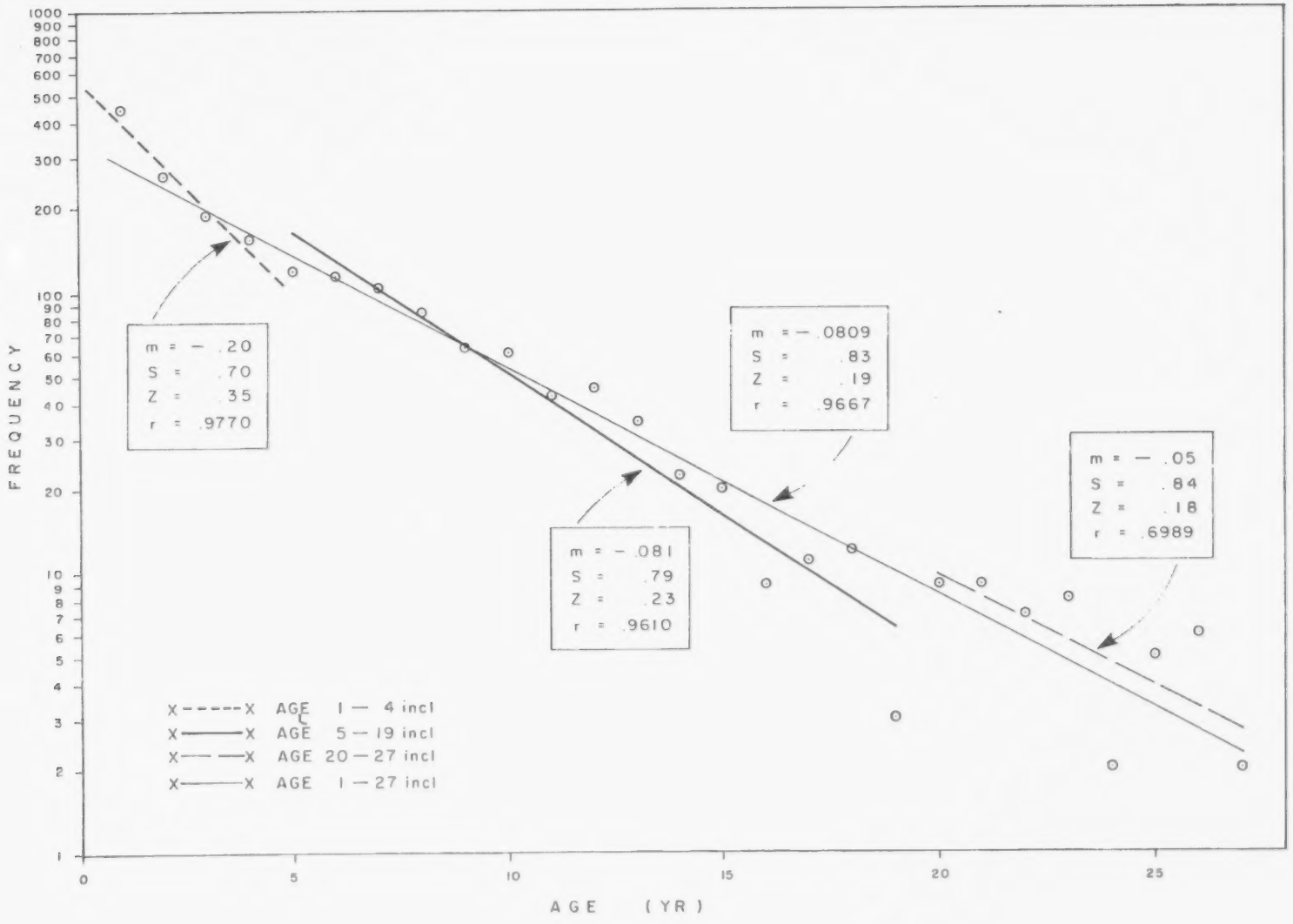

Fig. 19. Catch curve for dogfish from the Strait of Georgia, June and July 1976. Mortality estimates calculated from the slope of the regression y=a+bx where y=$\log_{10}$ frequency and x=age in years. Mortality estimates for age 1-27 inclusive determined from Robson and Chapman (1961).

Appendix Table 1. Common and scientific names of fishes captured, July 13-29, 1976.

Common name	Scientific name
Arrowtooth flounder	*Atheresthes stomias*
Blackfin sculpin	*Malacocottus kincaidi*
Bocaccio	*Sebastes paucispinis*
Brown cat shark	*Apristurus brunneus*
Calfiornia headlightfish	*Diaphus theta*
Canary rockfish	*Sebastes pinniger*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*
Coho salmon	*Oncorhynchus kisutch*
Eulachon	*Thaleichthys pacificus*
Jack mackerel	*Trachurus symmetricus*
Lingcod	*Ophiodon elongatus*
Northern anchovy	*Engraulis mordax mordax*
Northern lampfish	*Stenobrachius leucopsarus*
Northern smoothtongue	*Leuroglossus stilbius schmidti*
Pacific cod	*Gadus macrocephalus*
Pacific hake	*Merluccius productus*
Pacific herring	*Clupea harengus pallasi*
Pacific lamprey	*Lampetra tridentata*
Pallid eelpout	*Lycodapus mandibularis*
Pink salmon	*Oncorhynchus gorbuscha*
Pygmy rockfish	*Sebastes wilsoni*
Ratfish	*Hydrolagus colliei*
Redstripe rockfish	*Sebastes proriger*
Ribbon barracudina	*Notolepis rissoi rissoi*
River lamprey	*Lampetra ayresi*
Rougheye rockfish	*Sebastes aleutianus*
Sablefish	*Anoplopoma fimbria*
Sharpchin rockfish	*Sebastes zacentrus*
Sockeye salmon	*Oncorhynchus nerka*
Spiny dogfish	*Squalus acanthias*
Tadpole snailfish	*Nectoliparis pelagicus*
Unknown sculpin	Cottidae
Walleye pollock	*Theragra chalcogramma*
Wattled eelpout	*Lycodes palearis*
Widow rockfish	*Sebastes entomelas*
Yellowtail rockfish	*Sebastes flavidus*

Appendix Table 2. Vertical temperature determinations (°C).

Depth (m)	Set no.									
	6	8	10	12	15	16	17	18	19	20
Surface	18.0	19.0	16.5	12.0	14.0	15.5	16.0	16.0	12.0	12.5
10	12.0	16.0	15.0	11.5	12.5	15.0	15.0	15.0	12.5	10.5
20	11.0	11.0	12.5	11.0	10.5	12.5	10.0	10.0	9.5	9.5
30	10.0	10.0	9.5	9.0	8.0	10.0	8.0	8.5	7.5	8.5
40	9.0	9.5	8.5	8.5	7.5	8.5	7.5	7.0	7.0	7.5
50	8.5	8.5	8.0	8.0	7.0	8.0	7.0	7.0	7.0	7.2
60	8.0	8.0	8.0	7.5	7.0	7.5	7.0	7.0	7.0	6.5
70	8.0	8.0	8.0	7.0	7.0	7.5	7.0	7.0	7.0	6.2
80	8.0	8.0	8.0	7.0	7.0	7.5	7.0	7.0	7.0	
90	8.0	7.5	8.0	6.5	7.0	7.5	7.0	7.0	7.0	
100	8.0	7.5	8.0	6.5	7.0	7.5	7.5	7.0	6.5	
120	8.0	8.0	7.5	6.5	7.0	7.5	6.5	6.5	6.5	
140	8.0	8.0	8.0		6.5	7.0	6.5	6.5	6.5	
160	8.0	8.0	8.0			7.0	6.5	6.5	6.5	
180			8.0			6.5	6.0			
200			8.0			6.5	6.0			
220			8.0			6.0				
240			8.0							
260										
274										

Appendix Table 2 (cont'd)

Depth (m)	Set no.									
	21	22	23	25	26	28	29	31	37	43
Surface	13.0	12.5	11.5	11.5	14.0	13.0	17.5	16.0	16.5	14.5
10	11.0	10.0	10.0	11.0	13.0	12.0	12.5	12.5	12.5	11.0
20	10.5	9.5	9.0	10.0	10.0	9.0	10.5	10.0	10.0	9.5
30	10.0	9.0	8.0	9.0	8.5	9.0	9.0	9.0	9.5	9.0
40	9.5	9.0	7.5	8.5	8.0	8.0	9.0	8.5	9.0	9.0
50	8.0	8.5	7.5	8.0	8.0	7.5	8.5	8.5	8.5	8.5
60	7.0	7.5	7.5	8.0	8.0	7.5	8.0	8.0	8.0	8.0
70	7.0	7.0	7.0	7.5	8.0	7.0	8.0	8.0	8.0	8.0
80	6.5	7.0	7.0	7.5	7.5	7.0	8.0	8.0	8.0	7.5
90	6.5	7.0	7.0	7.5	7.5	6.5	8.0	8.0	8.0	7.5
100		6.5	7.0	7.5			8.0	8.0	8.0	7.5
120		6.5	7.0				8.0	8.0	8.0	7.5
140		6.5	7.0				8.0	8.0	8.0	7.5
160		6.5	7.0				8.0	8.0	8.0	7.5
180		6.2	7.0				8.0	8.0	8.0	7.5
200			7.0				8.0	8.0	8.0	7.5
220			6.5					8.0	8.0	7.5
240			6.5					8.0	8.0	7.8
260								8.0	8.0	8.0
274								8.0	8.0	8.0

Appendix Table 3. Set information.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 13 Set/haul no: 1

Location: S. of Winchelsea Is. Area: Strait of Georgia

Start: Lat. 49°15.6'N Long. 123°55.4'W

End: Lat. 49°15.7'N Long. 124°1.4'W

min.

Gear: Diamond 5B Start time (PDT): 1330 Duration: 15

Bottom depth m: Start: 375 End: 125 Est. av. depth: -

Net Depth Range m: 50-70 Est. av. depth: 55

mi.

Direction of set °true: NW Speed kn: 4.4 Distance travelled: -

Target: 55 m Water condition: Light chop Tide: Slack

Wind direction: Southeast Wind speed: 15 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net opening~12 m

Sounder summary: Heavy spotting 55-70 cm.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 13 Set/haul no: 2

Location: N. off Five Finger Is. Area: Strait of Georgia

Start: Lat. 49°15.2'N Long. 123°54.7'W

End: Lat. 49°14.3'N Long. 123°52.0'W

min.

Gear: Diamond 5B Start time (PDT): 1520 Duration: 30

Bottom depth m: Start: 292 End: 250 Est. av. depth: 270

Net Depth Range m: 50-70 Est. av. depth: 55

mi.

Direction of set °true: 118 Speed kn: 3.5 Distance travelled: -

Target: 55 m Water condition: Light chop Tide: Flood

Wind direction: South Wind speed: - Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~ 12.5 m; 1/4 of dogfish 'gilled' in wing of net

Sounder summary: Some light spotting 55-65 m; occasional light scattering 180 m - bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 14 Set/haul no: 3

Location: S. E. of Winchelsea Is. Area: Strait of Georgia

Start: Lat. 49°15.5'N Long. 123°59.3'W

End: Lat. 49°14.7'N Long. 123°57.1'W

min.

Gear: Diamond 5B Start time (PDT): 0930 Duration: 30

Bottom depth m: Start: 210 End: 172 Est. av. depth: 191

Net Depth Range m: 57-84 Est. av. depth: 64

mi.

Direction of set °true: 120 Speed kn: 3.5 Distance travelled: 1.75

Target: 64 m Water condition: Ripple Tide: Ebb

Wind direction: Northwest Wind speed: 10 Recorder: MSS & RJB

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~ 13.0 m

Sounder summary: Heavy spotting 54-72 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 14 Set/haul no: 4

Location: S. E. of Winchelsea Is. Area: Strait of Georgia

Start: Lat. 49°15.5'N Long. 123°59.3'W

End: Lat. 49°14.7'N Long. 123°57.1'W

min.

Gear: Diamond 5B Start time (PDT): 1254 Duration: 30

Bottom depth m: Start: 203 End: 187 Est. av. depth: 195

Net Depth Range m: 49-31 Est. av. depth: 40

mi.

Direction of set °true: 120 Speed kn: 4.1 Distance travelled: -

Target: 37 m Water condition: Ripple Tide: -

Wind direction: - Wind speed: - Recorder: MSS & RJB

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~ 11.0 m

Sounder summary: Heavy spotting 75-110 m; some light scatter 110-150 m

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 14 Set/haul no: 5

Location: S. end of firing range Area: Strait of Georgia

Start: Lat. 49°17.3'N Long. 123°47.9'W

End: Lat. 49°15.3'N Long. 123°48.1'W

min.

Gear: Diamond 5B Start time (PDT): 1800 Duration: 30

Bottom depth m: Start: 410 End: 410 Est. av. depth: 410

Net Depth Range m: 256-280 Est. av. depth: 275

mi.

Direction of set °true: 180 Speed kn: - Distance travelled: -

Target: 311 m Water condition: Light chop Tide: Flood

Wind direction: Northwest Wind speed: 10 Recorder: MSS & RJB

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~12.8 m

Sounder summary: Individual spotting 90-137 m; heavy scatter 162-306 m; no distinct layering.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 16 Set/haul no: 6

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°10.5'N Long. 123°39.5'W

End: Lat. 49°10.9'N Long. 123°42.7'W

min.

Gear: Diamond 5B Start time (PDT): 1330 Duration: 45

Bottom depth m: Start: 180 End: 150 Est. av. depth: 165

Net Depth Range m: 40-77 Est. av. depth: 73

mi.

Direction of set °true: 294 Speed kn: 3.9 Distance travelled: -

Target: 73m Water condition: Calm Tide: Ebb

Wind direction: - Wind speed: 0 Recorder: MSS

ttm: - tdm: - bt: #1 Other oceanographic data: -

Remarks: Net open ~11 m; using 4 m superkrub boards and chains to replace weights

Sounder summary: Moderate spotting 50-100 m; heavy scatter 110-160 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 16 Set/haul no: 7

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°10.2'N Long. 123°39.6'W

End: Lat. 49°10.7'N Long. 123°40.7'W

min.

Gear: Diamond 5B Start time (PDT): 1548 Duration: 18

Bottom depth m: Start: 165 End: 190 Est. av. depth: 178

Net Depth Range m: 73-91 Est. av. depth: 90

mi.

Direction of set °true: 288 Speed kn: 3.5 Distance travelled: -

Target: 91 m Water condition: Calm Tide: Flood

Wind direction: - Wind speed: 0 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~12.8 m

Sounder summary: Heavy spotting 85-95 m; light scatter 95 m to bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 16 Set/haul no: 8

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°9.6'N Long. 123°38.7'W

End: Lat. 49°10.2'N Long. 123°39.7'W

min.

Gear: Diamond 5B Start time (PDT): 2223 Duration: 30

Bottom depth m: Start: 208 End: 165 Est. av. depth: 190

Net Depth Range m: 55-95 Est. av. depth: 91

mi.

Direction of set °true: 287 Speed kn: 3.3 Distance travelled: 1.5

Target: 91 m Water condition: Light chop Tide: Slack

Wind direction: Northwest Wind speed: 10 Recorder: MSS

ttm: - tdm: - bt: #2 Other oceanographic data: -

Remarks: Net open ~10 m

Sounder summary: 3 distinct scattering layers; 50-55 m, 75-82 m, 91-100 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 16 Set/haul no: 9

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°9.5'N Long. 123°38.3'W

End: Lat. 49°10.3'N Long. 123°39.7'W

min.

Gear: Diamond 5B Start time (PDT):2345 Duration: 30

Bottom depth m: Start: 210 End: 185 Est. av. depth: 198

Net Depth Range m: 55-33 Est. av. depth: 36

mi.

Direction of set °true: 293 Speed kn: - Distance travelled: ~1.8

Target: 37 m Water condition: Chop Tide: -

Wind direction: Northwest Wind speed: 20 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~10.5 m

Sounder summary: 3 distinct scattering layers; 18-30 m, 50-64 m, 90-115 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 17 Set/haul no: 10

Location: north of Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°12.9'N Long. 123°39.0'W

End: Lat. 49°15.5'N Long. 123°40.8'W

min.

Gear: Diamond 5B Start time (PDT):0953 Duration: 30

Bottom depth m: Start: 382 End: 391 Est. av. depth: 386

Net Depth Range m: 146-278 Est. av. depth: 278

mi.

Direction of set °true: 309 Speed kn: 4.4 Distance travelled: -

Set on: 256-274 m Water condition: Chop Tide: -

Wind direction: Northwest Wind speed: 20 Recorder: MSS

ttm: - tdm: - bt: #3 Other oceanographic data: -

Remarks: Net open ~ 14.6 m

Sounder summary: Moderate scattering layer 120-160 m; very light scattering layer 240-300 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 17 Set/haul no: 11

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°12.0'N Long. 123°37.7'W

End: Lat. 49°13.3'N Long. 123°39.0'W

min.

Gear: Diamond 5B Start time (PDT):1143 Duration: 30

Bottom depth m: Start: 388 End: 380 Est. av. depth: 342

Net Depth Range m: 114-143 Est. av. depth: 128

mi.

Direction of set °true: 325 Speed kn: 3.8 Distance travelled: 1.6

Target: 110-140 m Water condition: Chop Tide: -

Wind direction: Northwest Wind speed: 15 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~10 m

Sounder summary: Light spotting 0-11 m; distinct scattering layer 110-146 m; occasional light spotting 146-220 m; very light scattering layer 220-275 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 18 Set/haul no: 12

Location: Finger Bank Area: west coast Vancouver Island

Start: Lat. 48°32.8'N Long. 125°31.7'W

End: Lat. 48°33.0'N Long. 125°32.6'W

min.

Gear: Diamond 5B Start time (PDT):0820 Duration: 20

Bottom depth m: Start: 124 End: 117 Est. av. depth: 120

Net Depth Range m: 55-65 Est. av. depth: 59

mi.

Direction of set °true: 270 Speed kn: 3.5 Distance travelled: 0.75

Target: 60 m Water condition: Calm Tide: -

Wind direction: West Wind speed: 10 Recorder: MSS

ttm: - tdm: - bt: #4 Other oceanographic data: -

Remarks: Net open ~11 m

Sounder summary: 2 distinct moderate spotting layers 55-75 m and 90-100 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 18 Set/haul no: 13

Location: Finger Bank Area: west coast Vancouver Island

Start: Lat. 48°32.6'N Long. 125°29.0'W

End: Lat. 48°31.3'N Long. 125°31.2'W

min.

Gear: Diamond 5B Start time (PDT): 1010 Duration: 35

Bottom depth m: Start: 110 End: 115 Est. av. depth: 115

Net Depth Range m: 55-80 Est. av. depth: 77

mi.

Direction of set °true: 230 Speed kn: 3.4 Distance travelled: 1.9

Target: 70 m Water condition: Light swell Tide: Flood

Wind direction: Northwest Wind speed: 10 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~7 m

Sounder summary: Moderate to heavy spotting 70-110 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 18 Set/haul no: 14

Location: Finger Bank Area: west coast Vancouver Island

Start: Lat. 48°32.6'N Long. 125°30.2'W

End: Lat. 48°33.8'N Long. 125°30.3'W

min.

Gear: Diamond 5B Start time (PDT): 1215 Duration: 30

Bottom depth m: Start: 113 End: 128 Est. av. depth: 115

Net Depth Range m: 105-80 Est. av. depth: 80

mi.

Direction of set °true: 010 Speed kn: 3.5 Distance travelled: -

Target: 75-80 m Water condition: Light swell Tide: Flood

Wind direction: Northwest Wind speed: 5 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~12 m; towed with the tide

Sounder summary: Moderate to heavy spotting 50-75 m; moderate scatter 75 m-bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 18 Set/haul no: 15

Location: west pf Destruction Island Area: Washington Coast

Start: Lat. 47°46.9'N Long. 125°2.5'W

End: Lat. 47°46.3'N Long. 125°2.2'W

Gear: Diamond 5B Start time (PDT):2005 Duration: 11 min.

Bottom depth m: Start: 146 End: 148 Est. av. depth: 147

Net Depth Range m: 117-129 Est. av. depth: 128

Direction of set °true: 180 Speed kn: 3.7 Distance travelled: 0.7 mi.

Target: 128 m Water condition: Light swell Tide: -

Wind direction: Northwest Wind speed: 5 Recorder: MSS

ttm: - tdm: - bt: #5 Other oceanographic data: -

Remarks: Net open ~12 m

Sounder summary: Very light scatter layer 10-20 m. Moderate spotting 125 m-bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 19 Set/haul no: 16

Location: west of Columbia River Area: Oregon Coast

Start: Lat. 45°47.8'N Long. 124°37.3'W

End: Lat. 45°46.3'N Long. 124°37.1'W

Gear: Diamond 5B Start time (PDT):1333 Duration: 30 min.

Bottom depth m: Start: 212 End: 212 Est. av. depth: 212

Net Depth Range m: 169-174 Est. av. depth: 171

Direction of set °true: 175 Speed kn: 2.5 Distance travelled: 1.5 mi.

Target: 169 Water condition: Swell Tide: -

Wind direction: South Wind speed: 10 Recorder: KW

ttm: - tdm: - bt: #6 Other oceanographic data: -

Remarks: Net open ~14 m.

Sounder summary: Faint spotting surface - 10 m; moderate occasional spotting 165-201 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 20 Set/haul no: 17

Location: off Tillamook Area: Oregon Coast

Start: Lat. 45°27.7'N Long. 124°16.8'W

End: Lat. 45°29.6'N Long. 124°17.7'W

min.

Gear: Diamond 5B Start time (PDT):1316 Duration: 37

Bottom depth m: Start: 166 End: 170 Est. av. depth: 168

Net Depth Range m: 150-138 Est. av. depth: 150

mi.

Direction of set °true: 345 Speed kn: 3.6 Distance travelled: 1.8

Target: 137 m Water condition:Mod. swell Tide: -

Wind direction: Northwest Wind speed: 10 Recorder: MSS

ttm: - tdm: - bt: #7 Other oceanographic data: -

Remarks: Net open ~12 m

Sounder summary: Light to moderate spotting 150 m-bottom; very light scattering layer 70-74 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 21 Set/haul no: 18

Location: off Stonewall Bank Area: Oregon Coast

Start: Lat. 44°36.3'N Long. 124°35.9'W

End: Lat. 44°34.5'N Long. 124°35.9'W

min.

Gear: Diamond 5B Start time (PDT):0705 Duration: 30

Bottom depth m: Start: 177 End: 200 Est. av. depth: 200

Net Depth Range m: 117-147 Est. av. depth: 130

mi.

Direction of set °true: 180 Speed kn: 2.5 Distance travelled: 1.7

Target: 128-146 m Water condition:calm / swellTide: Strong

Wind direction: Northwest Wind speed: 5 Recorder: MSS

ttm: - tdm: - bt: #8 Other oceanographic data: -

Remarks: Net open ~12 m; let out additional 91 m of warp-20 min. into tow.

Sounder summary: Heavy spotting 90-128 m; moderate continuous spotting 150-200 m. Wavy plankton scattering layer on surface 0-18 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 21 Set/haul no: 19

Location: Heceta Bank Area: Oregon Coast

Start: Lat. ° ' Long. ° '

End: Lat. ° ' Long. ° '

min.

Gear: Diamond 5B Start time (PDT): 1025 Duration: 30

Bottom depth m: Start: 142 End: 144 Est. av. depth: 143

Net Depth Range m: 111-120 Est. av. depth: 120

mi.

Direction of set °true: 185 Speed kn: 2.5 Distance travelled: -

Target: 126 m Water condition: Light swell Tide: -

Wind direction: - Wind speed: < 5 Recorder: MSS

ttm: - tdm: - bt: #9 Other oceanographic data: -

Remarks:

Sounder summary: Heavy spotting 120 m-bottom; very fine scattering layer 10-18 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 22 Set/haul no: 20

Location: opposite Port Renfrew Area: Strait of Juan de Fuca

Start: Lat. ° ' Long. ° '

End: Lat. ° ' Long. ° '

min.

Gear: Diamond 5B Start time (PDT): 2047 Duration: 90

Bottom depth m: Start: 103 End: 92 Est. av. depth: 98

Net Depth Range m: 9-53; 29-53 Est. av. depth: 13; 41

mi.

Direction of set °true: 270 Speed kn: 4.3 Distance travelled: -

Target: - Water condition: Slight swell Tide: -

Wind direction: Southwest Wind speed: 5 Recorder: KW

ttm: - tdm: - bt: #10 Other oceanographic data: -

Remarks: Net open ~12.8 m; last 15 min. of tow, raised net to 9-15 m.

Sounder summary: Light spotting 27-37 m; and 70 m-bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 23 Set/haul no: 21

Location: off Jordan River Area: Strait of Juan de Fuca

Start: Lat. 48°22.5'N Long. 124°0.3'W

End: Lat. 48°23.1'N Long. 124°3.4'W

min.

Gear: Diamond 5B Start time (PDT):1130 Duration: 30

Bottom depth m: Start: 105 End: 95 Est. av. depth: 100

Net Depth Range m: 57-77 Est. av. depth: 70

mi.

Direction of set °true: 298 Speed kn: 3.5 Distance travelled: ~1.7

Target: 65-75 m Water condition: Calm Tide: -

Wind direction: - Wind speed: Nil Recorder: MSS

ttm: - tdm: - bt: #11 Other oceanographic data: -

Remarks: Net open ~11 m

Sounder summary: Moderate spotting 65-85 m; heavy spotting 90 m-bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 23 Set/haul no: 22

Location: south of Port San Juan Area: Strait of Juan de Fuca

Start: Lat. 48°25.3'N Long. 124°21.0'W

End: Lat. 48°25.5'N Long. 124°23.6'W

min.

Gear: Diamond 5B Start time (PDT):1340 Duration: 30

Bottom depth m: Start: 192 End: 196 Est. av. depth: 194

Net Depth Range m: 20-30 Est. av. depth: 25

mi.

Direction of set °true: 295 Speed kn: 3.2/4.2 Distance travelled: -

Target: 9-30 m Water condition: Calm Tide: Ebb

Wind direction: - Wind speed: Nil Recorder: MSS

ttm: - tdm: - bt: #12 Other oceanographic data: -

Remarks: Net open ~9 m; first ½ tow net at 18-30 m, 2nd ½ tow net at 10-20 m.

Sounder summary: Light occasional spotting 100 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 23 Set/haul no: 23

Location: off Port San Juan Area: Strait of Juan de Fuca

Start: Lat. 48°27.8'N Long. 124°30.7'W

End: Lat. 48°28.2'N Long. 124°36.7'W

min.

Gear: Diamond 5B Start time (PDT): 1525 Duration: 50

Bottom depth m: Start: 220 End: 238 Est. av. depth: 230

Net Depth Range m: 82-110 Est. av. depth: 95

mi.

Direction of set °true: 275 Speed kn: ~3.0 Distance travelled: 4.0

Target: 100 m Water condition: Light ripple Tide: Flood

Wind direction: West Wind speed: < 5 Recorder: MSS

ttm: - tdm: - bt: #13 Other oceanographic data: -

Remarks: Net open ~9 m

Sounder summary: Moderate spotting 100-110 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 23 Set/haul no: 24

Location: Mid Strait-Cape Flattery Area: Strait of Juan de Fuca

Start: Lat. 48°30.8'N Long. 124°42.6'W

End: Lat. 48°30.8'N Long. 124°46.3'W

min.

Gear: Diamond 5B Start time (PDT): 2210 Duration: 30

Bottom depth m: Start: 384 End: 293 Est. av. depth: 339

Net Depth Range m: 9-23 Est. av. depth: 15

mi.

Direction of set °true: 270 Speed kn: 4.5 Distance travelled: 3

Target: Just below surface Water condition: Slight swell Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~7 m.

Sounder summary: Moderate spotting 22 m to bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 24 Set/haul no: 25

Location: Cabbage Patch Area: west coast Vancouver Island

Start: Lat. 48°46.7'N Long. 125°32.5'W

End: Lat. 48°45.7'N Long. 125°27.5'W

min.

Gear: Diamond 5B Start time (PDT):1335 Duration: 55

Bottom depth m: Start: 126 End: 106 Est. av. depth: 110

Net Depth Range m: 91-69 Est. av. depth: 80

mi.

Direction of set °true: 107 Speed kn: 4.2 Distance travelled: 3.5

Target: 81-91 m Water condition: Chop Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: #14 Other oceanographic data: -

Remarks: Net open ~9 m

Sounder summary: Occasional heavy spotting 64-75 m; moderate spotting layer 81-91 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 24 Set/haul no: 26

Location: South Bank Area: west coast Vancouver Island

Start: Lat. 48°55.5'N Long. 125°38.5'W

End: Lat. 48°54.3'N Long. 125°36.3'W

min.

Gear: Diamond 5B Start time (PDT):1748 Duration: 30

Bottom depth m: Start: 99 End: 93 Est. av. depth: 96

Net Depth Range m: 72-69 Est. av. depth: 69

mi.

Direction of set °true: 135 Speed kn: 4.0 Distance travelled: 1.9

Target: 85 m Water condition: Chop Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: #15 Other oceanographic data: -

Remarks: Net open ~11 m

Sounder summary: Heavy spotting 86-91 m; light scattering 1-25 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 25 Set/haul no: 27

Location: Finger Bank Area: west coast Vancouver Island

Start: Lat. 48°32.5'N Long. 125°23.4'W

End: Lat. 48°33.1'N Long. 125°19.5'W

min.

Gear: Diamond 5B Start time (PDT):1455 Duration: 30

Bottom depth m: Start: 154 End: 134 Est. av. depth: 144

Net Depth Range m: 73-77 Est. av. depth: 76

mi.

Direction of set °true: 210 Speed kn: 4.0 Distance travelled: 4.6

Target: 77-89 Water condition: Swell chop Tide: Strong

Wind direction: Northwest Wind speed: 10 Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~10 m

Sounder summary: Heavy spotting layer 77-89 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 25 Set/haul no: 28

Location: South of Finger Bank Area: West Coast Vancouver Island

Start: Lat. 48°30.2'N Long. 125°23.1'W

End: Lat. 48°31.2'N Long. 125°23.4'W

min.

Gear: Diamond 5B Start time (PDT):1850 Duration: 30

Bottom depth m: Start: 146 End: 110 Est. av. depth: 125

Net Depth Range m: 110-75 Est. av. depth: 79

mi.

Direction of set °true: 350 Speed kn: 4.0 Distance travelled: 2.0

Target: 75-85 m Water condition: Light chop Tide: Strong

Wind direction: Northwest Wind speed: 10 Recorder: MSS

ttm: - tdm: - bt: #16 Other oceanographic data: -

Remarks: Net open ~9 m

Sounder summary: Light to moderate spotting 75-85 m; light scattering layer 128 m to bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 26 Set/haul no: 29

Location: Winchelsea Island Area: Strait of Georgia

Start: Lat. 48°16.5'N Long. 124°1.5'W

End: Lat. 48°14.5'N Long. 124°1.5'W

min.

Gear: Diamond 5B Start time (PDT):1135 Duration: 45

Bottom depth m: Start: 183 End: 238 Est. av. depth: 211

Net Depth Range m: 9-18 Est. av. depth: 13

mi.

Direction of set °true: 125 Speed kn: 5.0 Distance travelled: -

Target: 9-18 m Water condition: Chop Tide: Ebb

Wind direction: Northwest Wind speed: 15 Recorder: KW

ttm: - tdm: - bt: #17 Other oceanographic data: -

Remarks: Net open ~7.3 m

Sounder summary: Medium spotting 110 m to bottom; heavy spotting layer 110-146 m. Heavy scatter 146 m-bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 26 Set/haul no: 30

Location: Winchelsea Island Area: Strait of Georgia

Start: Lat. 48°16.5'N Long. 124°1.5'W

End: Lat. 48°14.5'N Long. 124°1.5'W

min.

Gear: Diamond 5B Start time (PDT):2230 Duration: 30

Bottom depth m: Start: 150 End: 256 Est. av. depth: 220

Net Depth Range m: Starboard door awash Est. av. depth: -

mi.

Direction of set °true: 114 Speed kn: 4.8 Distance travelled: -

Target: 9-18 m Water condition: Chop Tide: -

Wind direction: Northwest Wind speed: 10 Recorder: KW & MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Broke transducer cable

Sounder summary: Light to moderate scattering layers 0-9 m; 100-109 m; 146 m-bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 27 Set/haul no: 31

Location: 4 mi. north of Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°13.1'N Long. 123°36.0'W

End: Lat. 49°13.3'N Long. 123°39.0'W

min.

Gear: Diamond 5B Start time (PDT): 1255 Duration: 35

Bottom depth m: Start: 348 End: 380 Est. av. depth: 380

Net Depth Range m: 146-154 Est. av. depth: 150

mi.

Direction of set °true: 300 Speed kn: 4.5 Distance travelled: ~2.5

Target: 146 m Water condition: Slight chop Tide: -

Wind direction: Northwest Wind speed: 10 Recorder: AC

ttm: - tdm: - bt: #18 Other oceanographic data: -

Remarks: Net open ~8 m

Sounder summary: (On 40 log) heavy scatter 135 m to bottom; occasional light spotting 180 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 28 Set/haul no: 32

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°12.6'N Long. 123°36.7'W

End: Lat. 49°13.5'N Long. 123°38.3'W

min.

Gear: Diamond 5B Start time (PDT): 1020 Duration: 30

Bottom depth m: Start: 384 End: 384 Est. av. depth: 384

Net Depth Range m: 146-161 Est. av. depth: 155

mi.

Direction of set °true: 307 Speed kn: 3.6 Distance travelled: -

Target: 155 m Water condition: Ripple Tide: -

Wind direction: Northwest Wind speed: < 10 Recorder: MSS

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~12 - 14.6 m

Sounder summary: Moderate spotting 54-91 m; moderate scatter 77 m to bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 28 Set/haul no: 33

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°11.4'N Long. 123°34.1'W

End: Lat. 49°10.5'N Long. 123°32.1'W

min.

Gear: Diamond 5B Start time (PDT):1145 Duration: 30

Bottom depth m: Start: 377 End: 364 Est. av. depth: 366

Net Depth Range m: 293-307-278 Est. av. depth: 293

mi.

Direction of set °true: 136 Speed kn: 2.3 Distance travelled: -

Target: 293 m Water condition: Ripple Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~10 m

Sounder summary: Light scatter layer 293-329 m.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 28 Set/haul no: 34

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°10.7'N Long. 123°34.9'W

End: Lat. 49°12.1'N Long. 123°36.7'W

min.

Gear: Diamond 5B Start time (PDT):1340 Duration: 30

Bottom depth m: Start: 390 End: 389 Est. av. depth: 390

Net Depth Range m: 366 Est. av. depth: 366

mi.

Direction of set °true: 321 Speed kn: 4.0 Distance travelled: -

Target: 347 m Water condition: Ripple Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~11.8 m

Sounder summary: Light occasional spotting 201-274 m; light scatter layer 293-329 m; moderate scatter 347 m to bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 28 Set/haul no: 35

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°12.2'N Long. 123°35.6'W

End: Lat. 49°11.9'N Long. 123°33.4'W

min.

Gear: Diamond 5B Start time (PDT): 1525 Duration: 30

Bottom depth m: Start: 203 End: 349 Est. av. depth: 320

Net Depth Range m: 220-227-212 Est. av. depth: 220

mi.

Direction of set °true: 100 Speed kn: 3.0 Distance travelled: 1.5

Target: 220 m Water condition: Light chop Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~13 m

Sounder summary: Light occasional spotting 146-256 m, moderate scattering 329 m to bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 28 Set/haul no: 36

Location: Thrasher Rock Area: Strait of Georgia

Start: Lat. 49°11.5'N Long. 123°34.4'W

End: Lat. 49°12.0'N Long. 123°35.5'W

min.

Gear: Diamond 5B Start time (PDT): 1720 Duration: 30

Bottom depth m: Start: 371 End: 384 Est. av. depth: 379

Net Depth Range m: 124-113-110 Est. av. depth: 112

mi.

Direction of set °true: 310 Speed kn: 4.0 Distance travelled: -

Target: 110 m Water condition: Mod. chop Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~15 m

Sounder summary: Light occasional spotting 73-128 m, scattering layer 128 m to bottom; (40 log shows 3 scattering layers, 145-150 m; 160-175 m; 225-260 m).

Appendix Table 3 (cont'd)

YC ;F %RU

Vessel: ARCTIC HARVESTER Date: 76 July 29 Set/haul no: 39 o

Location: Mid-str.between C. Lazo & TexadaIs Area: Strait of Georgia

Start: Lat. 49°44.3'N Long. 124°43.3'W

End: Lat. 49°45.0'N Long. 124°44.6'W

min.

Gear: Diamond 5B Start time (PDT): 1020 Duration: 30

Bottom depth m: Start: 329 End: 338 Est. av. depth: 334

Net Depth Range m: 256-293 Est. av. depth: 294

mi.

Direction of set °true: 310 Speed kn: 3.0 Distance travelled: -

Target: 293 m Water condition: - Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~ 11.9 m

Sounder summary: Very little distinction between layers below 210 m. (40 log indicates a scatter layer 201-311 m; thin layer 329 m-bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 29 Set/haul no: 40

Location: Mid-str.between C. Lazo & TexadaIs Area: Strait of Georgia

Start: Lat. 49°46.7'N Long. 124°45.2'W

End: Lat. 49°44.9'N Long. 124°43.7'W

min.

Gear: Diamond 5B Start time (PDT): 1150 Duration: 30

Bottom depth m: Start: 342 End: 337 Est. av. depth: 339

Net Depth Range m: 11-14 Est. av. depth: 12

mi.

Direction of set °true: 150 Speed kn: 4.0 Distance travelled: -

Target: 9-18 m Water condition: Ripple Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~ 9.1 m

Sounder summary: Moderate spotting 90-183 m; moderate scatter layer 167-201 m; light scatter continuous to bottom.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 29 Set/haul no: 41

Location: Mid-str.between C. Lazo & TexadaIs Area: Strait of Georgia

Start: Lat. 49°45.4'N Long. 124°44.4'W

End: Lat. 49°44.8'N Long. 124°46.6'W

min.

Gear: Diamond 5B Start time (PDT): 1300 Duration: 30

Bottom depth m: Start: 327 End: 298 Est. av. depth: 312

Net Depth Range m: 113-117 Est. av. depth: 112

mi.

Direction of set °true: 308 Speed kn: 3.5 Distance travelled: -

Target: 119-128 m Water condition: Calm Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~11.0 m

Sounder summary: Moderate spotting 99-146 m; moderate scatter layer 167-201 m; light scatter 201 m to bottom.

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 29 Set/haul no: 42

Location: Mid-str.between C. Lazo & TexadaIs Area: Strait of Georgia

Start: Lat. 49°45.6'N Long. 124°45.2'W

End: Lat. 49°44.7'N Long. 124°42.8'W

min.

Gear: Diamond 5B Start time (PDT): 1425 Duration: 30

Bottom depth m: Start: 357 End: 353 Est. av. depth: 355

Net Depth Range m: 212-250 Est. av. depth: 227

mi.

Direction of set °true: 125 Speed kn: 3.0 Distance travelled: -

Target: 220 m Water condition: Calm Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: - Other oceanographic data: -

Remarks: Net open ~11 m

Sounder summary: Light spotting 91-150 m; moderate scatter layer 159-183 m; light scatter 183-274 m.

Appendix Table 3 (cont'd)

Yr Mo Day

Vessel: ARCTIC HARVESTER Date: 76 July 29 Set/haul no: 43

Location: Mid-str.between C. Lazo & TexadaIs Area: Strait of Georgia

Start: Lat. 49°45.1'N Long. 124°45.0'W

End: Lat. 49°46.0'N Long. 124°45.7'W

min.

Gear: Diamond 5B Start time (PDT): 1600 Duration: 30

Bottom depth m: Start: 355 End: 344 Est. av. depth: 350

Net Depth Range m: 274-285 Est. av. depth: 278

mi.

Direction of set °true: 305 Speed kn: 3.5 Distance travelled: -

Target: 274 m Water condition: Calm Tide: -

Wind direction: - Wind speed: - Recorder: AC

ttm: - tdm: - bt: #20 Other oceanographic data: -

Remarks: Net open ~12.8 m

Sounder summary: Light spotting 91-150 m; light scattering layer 159-183 m; moderate scattering 183-274 m.